Kalamazoo river cleanup group
AREAS 2, 3 AND 4 TCRA

January 21, 2022

Area 4 Mussel Salvage Report (2020/2021)

OU5 Area 4 Time-Critical Removal Action
Allied Paper/Portage Creek/
Kalamazoo River Superfund Site

Prepared for:
Kalamazoo River Areas 2, 3, and 4 Remediation LLC

GEI Consultants

Area 4 Mussel Salvage Report (2020/2021)

OU5 Area 4 Time-Critical Removal Action
Allied Paper/Portage Creek/
Kalamazoo River Superfund Site

Prepared for:
Kalamazoo River Areas 2, 3, and 4 Remediation LLC
864 Spring Street NW
Atlanta, Georgia 30308-1007

Prepared By:
GEI Consultants of Michigan, P.C.
3065 Akers Mill Road, Suite 235
Atlanta, GA 30339

January 21, 2022

GEI Project No. 2000273

Table of Contents

Tables

Figures

Appendices

Revision History

Issued By:	GEI Consultants of Michigan, P.C.

Document Revision Record

Issue No.	Date	Details of Revisions

Abbreviations and Acronyms

cm	centimeters
CD	Consent Decree
ESI	Environmental Solutions and Innovations, Inc.
EPA	United States Environmental Protection Agency
GEI	GEI Consultants of Michigan, P.C.
GPS	Global positioning system
HHRA	human health risk assessment
LDB	left descending bank
LLC	Kalamazoo River Areas 2, 3, and 4 Remediation LLC
m^2	square meter
MDNR	Michigan Department of Natural Resources
MNFI	Michigan Natural Features Inventory
mg/kg	milligrams per kilogram
NCR	NCR Corporation
OU5	Operable Unit 5
PCBs	polychlorinated biphenyls
RDB	right descending bank
RM	river mile
Site	Area 4, OU5 of the Allied Paper/Portage Creek/Kalamazoo River Superfund Site
TCRA	time-critical removal action
USFWS	United States Fish and Wildlife Service

Executive Summary

GEI Consultants of Michigan, P.C. (GEI) is pleased to provide this 2020/2021 Draft Area 4 Mussel Salvage Report for Area 4 of Operable Unit 5 (OU5) of the Allied Paper/Portage Creek/Kalamazoo River Superfund Site (Site).

The scope of the Area 4 mussel salvage effort was discussed during a March 10, 2020, meeting with biologists from GEI and the Michigan Department of Natural Resources (MDNR). In May 2020, a reconnaissance effort was conducted that focused on characterizing bottom substrates and flow within the proposed remediation areas of Subareas E, F, and G, and similarly assessing potential upstream relocation areas (recommended by MDNR). Results of the reconnaissance effort were used to generate maps displaying polygons of suitable mussel habitat within Subareas E, F, and G, which were incorporated in a revised Mussel Work Plan submitted to stakeholders and subsequently approved in June 2020.

The Area 4, Subarea E, F, and G mussel salvage efforts were conducted in the summers of 2020 and 2021. Approximately 65%of the total suitable mussel habitat areas that were safely accessible were cleared in 2020, including all suitable areas of Subareas F and G. All remaining suitable habitat in Subarea E was cleared of mussels in 2021, with highly mobile sand being found throughout much of the remaining areas.

A total of 196 mussels were relocated, with nine species represented. White Heelsplitter (*Lasmigona complanata*) and Mucket (*Actinonaias ligamentina*) were the most abundant species found in Area 4, Subareas E, F, and G. No mussels on the state or federal threatened or endangered species lists were found; however, species of state special concern, Elktoe (*Alasmidonata marginata*), Fluted-Shell (*Lasmigona costata*), and Paper Pondshell (*Utterbackia imbecillis*) were found. All mussel species found in Area 4, Subareas E, F, and G had also been documented in the Kalamazoo River during previous mussel survey efforts performed by other biologists conducting surveys between 2001 and 2017.

Unless otherwise noted, all techniques were in accordance with the Mussel Work Plan (GEI, 2020).

1. Introduction

GEI Consultants of Michigan, P.C. (GEI) is pleased to provide this 2020/2021 Mussel Salvage Report for Area 4 (Subareas E, F, and G) of Operable Unit 5 (OU5) of the Allied Paper/Portage Creek/Kalamazoo River Superfund Site (Site; Figure 1). Work was performed by GEI on behalf of the Kalamazoo River Areas 2, 3, and 4 Remediation LLC (LLC), which NCR Corporation (NCR) formed to meet certain requirements of the Consent Decree (CD) between NCR Corporation, the United States Environmental Protection Agency (EPA), and the state of Michigan.

The CD was lodged in December 2019 and entered (approved) by the United States District Court for the Western District of Michigan on December 2, 2020. The CD requires NCR to conduct response activities in Areas 2, 3, and 4 of Operable Unit 5 of the Allied Paper/Portage Creek/Kalamazoo River Superfund Site. Work activities mandated by the CD include performance of a time-critical removal action (TCRA) in Area 4, remedial design, and remedial action in Area 2, and, unless an opt-out is exercised, remedial design and remedial action in Area 3.

1.1 Purpose and Background

The purpose of the Area 4 TCRA mussel salvage effort was to locate as many live mussels as possible within Subareas E, F, and G and relocate the mussels to an approved upstream relocation area in advance of planned dredging operations in Subareas E, F, and G.

Michigan is one of several states with written protocol designed to guide mussel survey and relocation efforts within lotic (flowing) waters. Michigan's protocol, entitled "*Michigan Freshwater Mussel Survey Protocols and Relocation Procedures*" (Hanshue et al, 2021), hereafter referred to as "Michigan's mussel protocol", was designed for "projects whose potential impacts are limited spatially to a few hundred meters of river or less (e.g., streambed disturbance, or temporarily increased sedimentation), not for projects or events impacting multiple kilometers of river (e.g., chemical or oil spills, mussel kills, or large dredging projects)."

Michigan's mussel protocol and its applicability to Area 4 mussel salvage efforts were discussed during a March 10, 2020, meeting with biologists from GEI and the Michigan Department of Natural Resources (MDNR). General agreement was reached that Area 4 TCRA mussel efforts should be considered a mussel "salvage" project given the large-scale dredging in advance of the removal of the Trowbridge Dam. As such, MDNR concurred that Michigan's mussel protocol does not apply to Area 4 TCRA mussel salvage efforts. In addition, agreement was reached during

the meeting that mussel salvage efforts covered under a Mussel Work Plan should focus on Area 4, Subareas E, F, and G, (Fig. 1) with any additional Area 4 mussel efforts (e.g., Subareas C and D, if necessary) captured under subsequent revised versions of the Mussel Work Plan. The Area 4 TCRA Mussel Work Plan, Rev 1.0, dated June 1, 2020 (Mussel Work Plan; GEI, 2020), was reviewed by the EPA, MDNR, and other project stakeholders (Appendix A).

In May 2020, a reconnaissance effort was conducted that focused on characterizing bottom substrates and flow within the proposed remediation areas of Subareas E, F, and G, and similarly assessing potential upstream relocation areas (recommended by MDNR). Results of the reconnaissance effort were used to generate maps displaying polygons of suitable mussel habitat, which were incorporated in a revised Mussel Work Plan (GEI, 2020).

1.2 Site Description

Area 4 of OU5 includes approximately 4.7 miles of the Kalamazoo River, its floodplain, and the currently and formerly impounded areas (commonly referred to as the Trowbridge impoundment) between the upstream former Otsego Township Dam (river mile [RM] 49.6) and the downstream Trowbridge Dam (RM 44.9). Area 4 is divided into eight subareas, with Subareas E, F, and G being located in the lower downstream portions of Area 4 (Fig. 1).

The Trowbridge Dam, located at the downstream end of Area 4, will be removed as part of the Area 4 TCRA scope of work. Parts of the dam were removed previously, lowering the impoundment from what it was before the 1970s. The current impoundment has an area of approximately 59 acres (AECOM, 2019Lentic-like conditions can be found in Subareas F and G, particularly during summer months, when there is minimal to no observable flow.

1.3 Previous Mussel Community Data

The freshwater mussel community of the Kalamazoo River has been characterized at multiple locations by various authors, with the following resources providing information most relevant to the mussel salvage work within Area 4:

- Mulcrone and Mehne reported the results of mussel surveys conducted in 2000 across 14 locations from Battle Creek to Saugatuck, Michigan. Two of the locations were in the vicinity of the Trowbridge impoundment. Sixteen live mussel species were documented during this effort (Mulcrone and Mehne, 2001).

- The Michigan Natural Features Inventory (MNFI) conducted a mussel shell survey in 2010 from Marshall to Battle Creek, Michigan. Shells from 16 mussel species were found during this effort (MNFI, 2010).
- Environmental Solutions and Innovations, Inc. (ESI) conducted multiple mussel salvage efforts from 2016 to 2018 in Area 3 of the Kalamazoo River, relocating a total of nine mussel species (ESI, 2017 and 2018).

The results of the aforementioned surveys are compared with the mussel community documented during 2020/2021 Area 4 salvage efforts in Section 5.5 of this report.

1.4 Permitting

The Area 4 mussel salvage efforts required Scientific Collector's and Threatened and Endangered Species permits from MDNR. An MDNR Land Use Permit was also required and obtained ahead of all mussel-related field activities. GEI secured these permits (Appendix B) prior to the initiation of any mussel salvage. Although GEI possesses a federal mussel permit (Permit Number TE33374D-0) from the United States Fish and Wildlife Service (USFWS), GEI did not need to request site-specific authorization from USFWS to relocate federally listed threatened or endangered species from Area 4 because federally listed mussels were not expected to be encountered (USFWS, 2020).

2. Pre-Salvage Reconnaissance Efforts

A multi-day reconnaissance effort was conducted in May 2020 to map areas containing suitable mussel habitat based on characterization of bottom substrates and flow within potential remediation areas of Subareas E, F, and G. Similar reconnaissance efforts were conducted in the potential upstream relocation areas that were recommended by MDNR. A brief summary of the reconnaissance effort methodology is below. A more detailed summary is provided in the Mussel Work Plan (Appendix A).

2.1 Substrate and Mussel Suitability Evaluation

During the reconnaissance effort, a total of 368 points along 95 transects across Subareas E, F, and G were evaluated with respect to:

- Water depth.
- Surface substrate types (sand, silt, gravel, cobble, boulder, detritus, hardpan, etc.).
- Presence/absence of macrophytes and woody debris.
- Substrate stability (stable/unstable, highly mobile, compaction, etc.).

Based on the information gathered, a determination as to the presence/absence of suitable (and unsuitable) mussel habitat at each transect point was made. The following substrate types and features were characterized as “unsuitable” habitat for mussels:

- Bedrock/hardpan.
- Homogeneous, unstable, and highly mobile substrate such as sand and silt.
- Homogeneous, unstable, and relatively unconsolidated substrates such as soft mucks, clays, silts, and detrital matter in backwater areas.
- Areas with dense coverage of large woody debris and/or detritus.

2.2 Safety Evaluation

Site access and potential safety issues, such as areas that could create unsafe conditions for scuba divers (e.g., elevated flow/current, underwater obstructions, limited visibility), were evaluated during the reconnaissance effort. In addition, GEI

conducted a screening-level human health risk assessment (HHRA) to assess potential risks to personnel coming in contact with Kalamazoo River sediment for extended periods of time during the mussel salvage. The screening-level HHRA recommended that mussel salvage efforts not be conducted in areas in which polychlorinated biphenyl (PCB) concentrations in sediment exceeded 25 milligrams per kilogram (mg/kg).

2.3 Mapping of Mussel Salvage Areas

Reconnaissance transect points that were categorized as having suitable mussel habitat were combined into polygons in ArcGIS. Those polygons were used to guide mussel salvage efforts in 2020 and 2021. Areas not safe for divers and where sediment PCB concentrations exceeded 25 mg/kg were also added to the mussel salvage polygons as areas to avoid (Fig. 2).

Mussel salvage “blocks” were established in each subarea in ArcGIS. Each block contained 100 mussel salvage “cells,” each cell being 100 square meters (m^2). The mussel salvage blocks were overlain on the aforementioned suitable mussel habitat polygons, generating the ArcGIS layer that would be used during mussel salvage efforts (Fig. 3).

2.4 Relocation Area Evaluation and Selection

Three potential mussel relocation areas upstream of Area 4 Subareas E, F, and G were evaluated during the reconnaissance effort (Appendix A). The most downstream relocation area, near the upstream boundary of Area 4 at RM 48.75, was found to have multiple stretches of suitable mussel habitat with sand/gravel and gravel/cobble substrate (Fig. 4). Water depth in these stretches was generally 4 feet or less and the current was acceptable for scuba diving. Of the three potential relocation areas recommended for evaluation by MDNR, this relocation area was also the closest to Subareas E, F, and G, which would allow for more efficient relocation of salvaged mussels at the end of each day. Global positioning system (GPS) coordinates at the approximate mid-point of the upstream relocation area are N 42.472923°, W 85.756391°.

3. Mussel Salvage and Relocation Methods

A safety meeting was held each morning with boat operators and members of the GEI dive/salvage team before starting mussel salvage. During the safety meeting, the block and cells in which mussel salvage would be conducted and the methods to be used were identified. The mussel salvage locations, techniques, and safety measures for divers to be used each day were reviewed in detail with boat captains and GEI dive/salvage team members. Mussel salvage locations and protocols were also shared with personnel conducting simultaneous sediment sampling on the river to maintain adequate separation and promote safe mussel salvage.

3.1 Substrate/Habitat Characterization

Substrate was characterized by divers throughout Area 4. Divers used hand-grubbing and conducted visual assessments of the substrate to determine substrate type(s) and overall habitat suitability for mussels. These evaluations generally occurred prior to timed searches for mussels. If unsuitable conditions such as little to no flow, highly mobile sand, thick silt deposits, muck, and/or dense patches of aquatic vegetation were dominant, then minimal search time for mussels was expended and the cell was categorized as containing unsuitable mussel habitat. Examples of unsuitable mussel substrate and/or conditions were outlined in Section 3.1 of the Mussel Work Plan (GEI, 2020). Additional representative photos of unsuitable substrate are in Appendix C (e.g., photos 92, 94, 97, 99, 100). Water quality parameters, such as water temperature, dissolved oxygen, specific conductance, and pH, were also measured throughout the mussel salvage effort using a calibrated *YSI Pro* water-quality meter.

3.2 Mussel Salvage

Two boats were used for Area 4 mussel salvage operations. Both boats launched from the Trowbridge Dam boat launch and used a *Trimble R1* global positioning system (GPS) capable of sub-meter accuracy to navigate to the appropriate mussel salvage block and cells.

A team of six to eight field staff typically conducted Area 4 mussel salvage. The team included biologists experienced with mussel survey and mussel identification and at least three certified scuba divers (usually four or five). Personnel not conducting mussel salvage operated GPS units, recorded data, acted as safety spotters, and kept track of dive time and diver position within mussel salvage cells.

Boats anchored in place via spud, typically near the upstream end of the mussel survey cell. Personnel would then mark the corners of a given salvage cell using colored buoys attached to high-visibility cinder blocks. While the cell corners were being marked, evaluations of water depth, flow conditions, visibility, and substrate type(s) were conducted. Those observations were used to determine the techniques and equipment that would be most effective and safe for mussel salvage in a particular cell. Representative photos of mussel salvage operations can be found in Appendix C. The following techniques were used during Area 4 mussel salvage efforts:

- **Water depth 3 feet or less:**
    - Tactile searches (hand-grubbing) using snorkel gear when necessary.
- **Water depth greater than 3 feet:**
    - Tactile and visual searches (when visibility was sufficient) using scuba gear; scuba divers were tethered to boats via a swift water dive harness and climbing rope/ascending system when current was greater than 1.5 feet per second.

Once the cell corners were marked, chain transects were stretched throughout the cell and mussel salvage commenced, starting from the downstream boundary of the cell and working upstream. Some cells did not require transects if the mussel salvage polygon was small. In most cases, two biologists worked together in a given cell, each searching one-half of a cell. Mussel search times were generally 1 minute/m^2, with search times being less in areas that were clearly lacking mussels and/or had unsuitable habitat. Multiple passes were made in areas where mussels were found. A cell was considered “cleared” once it had been searched in its entirety or if the substrate/habitat was deemed not suitable for mussels based on inspection by divers as described in Section 4.2.

Live mussels were extracted from the streambed and temporarily stored in flow-through mesh bags or buckets filled with Kalamazoo River water that received regular water exchanges. Mussels were kept out of direct sunlight unless they were being handled for identification, measurement, and/or photographing.

Mussels were identified by biologists with experience and training in the identification of mussels from Great Lakes states. Taxonomic keys such as *Pocket Field Guide to the Freshwater Mussels of Michigan* (Mulcrone and Rathbun, 2018), *Photo Field Guide to the Freshwater Mussels of Ontario* (Metcalfe-Smith et al, 2005), and *The Freshwater Mussels of Ohio* (Watters et al, 2009) were consulted when there was discussion among biologists about the classification of a specimen.

Mussels were measured to the nearest millimeter using calipers and representative photographs (i.e., left valve, right valve, dorsal view) of each species were taken (Appendix C). Information including species, shell length, and site conditions (such as water depth, visibility, and substrate type) was recorded in electronic field data sheets. If found, state and/or federally listed mussels would have been marked or tagged for post-relocation monitoring.

3.3 Mussel Relocation

Mussels were positioned in the relocation area (Fig. 4) in the proper orientation (siphons up) at the end of each day. To the extent possible, species were placed in the same type of substrate in which they were found (i.e., species found in sand/gravel were relocated to sand/gravel). Care was taken to avoid overcrowding of relocated mussels and to avoid wading through areas where mussels had previously been relocated.

4. Results and Discussion

4.1 Reconnaissance Results

A total of 62,417 m^2 of Subareas E, F, and G was considered to have suitable mussel habitat based on the criteria described in the Mussel Work Plan. From that, a total of 6,603 m^2 was excluded from mussel salvage efforts due to unsafe diving conditions or elevated PCB concentrations (Section 3.2), leaving a total mussel salvage footprint of 55,814 m^2 across Subareas E, F, and G. The size of the mussel salvage footprint in each subarea is described below and Fig. 2 shows polygons with suitable mussel substrate and areas excluded from salvage efforts due to unsuitable habitat and/or unsafe conditions. Appendix A contains representative photos from the reconnaissance effort.

4.1.1 Subarea E

Within Subarea E, 38,067 m^2 contained suitable mussel habitat. Of this, 6,018 m^2 was excluded from salvage efforts due to unsafe diving conditions (i.e., within 500 feet of Trowbridge Dam and/or had current too swift for diving) or due to previous data indicating sediment PCB concentrations in excess of 25 mg/kg. This resulted in a total mussel salvage area of 32,049 m^2 in Subarea E (Fig. 2).

4.1.2 Subarea F

Within Subarea F, 22,327 m^2 contained suitable mussel habitat. Of this, 585 m^2 was excluded from salvage efforts due to previous data indicating sediment PCB concentrations in excess of 25 mg/kg, resulting in a total mussel salvage area of 21,742 m^2 in Subarea F (Fig. 2).

4.1.3 Subarea G

Much of the north and northeast region of Subarea G was inaccessible by boat during the May 2020 reconnaissance effort due to dense stands of narrowleaf and hybrid cattail (*Typha angustifloia* and *T.* x *glauca*.) and shallow water. These areas contained little flow and poor mussel habitat and were excluded from mussel salvage efforts, resulting in a total mussel salvage area of 2,023 m^2 in Subarea G (Fig. 2).

4.2 Mussel Salvage Results

Approximately 65%(36,199 m^2) of the total mussel salvage footprint in Subareas E, F, and G was cleared of mussels in 2020, which included all of Subareas F and G. All remaining areas in Subarea E were cleared of mussels in 2021 (Fig. 3).

A total of 196 live mussels representing nine species were salvaged and relocated from Subareas E, F, and G (Table 1). Neither state- nor federal-listed mussels were found; however, state species of special concern Elktoe (*Alasmidonta marginata*), Fluted-shell (*Lasmigona costata*), and Paper Pondshell (*Utterbackia imbecillis*) were found. Mussels were not marked or tagged given listed species were not found and relatively low numbers of mussels were encountered. The upstream relocation area where all mussels were placed is shown in Fig. 4.

Mussel community data specific to each subarea is reported below. Representative photos of mussel species and of salvage efforts are provided in Appendix C.

4.2.1 Subarea E

In 2020, mussel salvage efforts were conducted in 12,434 m^2 of Subarea E, with the remaining 19,615 m^2 cleared of mussels in 2021 (Fig. 3). Sand was the most common substrate type found in Subarea E and in some cases was the only substrate type found in a mussel salvage block. Silt was the next most abundant type of substrate in Subarea E. Substrate coverage data for each 100-m^2 salvage cell are available upon request. Table 2 reports average substrate coverage in each mussel salvage block. In 2021, large deposits of silt and fine-grained sand, sometimes 18–24 inches thick, were observed in Subarea E, particularly along the LDB in blocks E1 and E2. Such deposits were not present in those areas during 2020 reconnaissance and mussel salvage efforts.

Water depth was variable throughout Subarea E, ranging from <1 foot to 8.2 feet during salvage efforts (Table 2). The shallowest areas were on large sand flats near the middle of the subarea and the deepest were off the LDB, downstream of the confluence with Subarea F (Fig. 3).

Water column visibility was variable and generally ranged from 15 to 30 centimeters (cm) early in the summer when flows were higher to >50 cm when conditions were drier and flows were lower. Current velocities were swift in parts of Subarea E, particularly in block E4, where divers were required to be tethered to the boats when conducting mussel salvage, and in block E2 (Fig. 3). Block E4 also had multiple downed trees along the LDB that could not be surveyed due to safety concerns associated with underwater entanglement (Appendix C photos 101, 102). In 2021,

portions of block E4 along the RDB were dry due to low water levels and not surveyed.

From Subarea E, 133 live mussels representing eight species were salvaged and relocated (Tables 3a, b; Figures 5a–5c). Mucket (*Actinonaias ligamentina*) and White Heelsplitter (*Lasmigona complanata*) were the most abundant species found. Subarea E is the only subarea where Elktoe and Fluted-shell (both state species of special concern) were found. The majority of the mussels salvaged in Subarea E came from three blocks: E2, near the downstream end of Subarea E; E5, near the confluence with Subarea F; and E11, at the upstream end of Subarea E (Figs. 5a–5c).

4.2.2 Subarea F

The entire Subarea F mussel salvage footprint (21,742 m^2 total) was searched for mussels in 2020 (Fig. 3). Silt was the most common substrate throughout Subarea F, with silt depths sometimes exceeding 2 feet. Silt coverage averaged 80%throughout all Subarea F mussel salvage blocks. Table 4 reports average substrate coverage in each mussel salvage block. Substrate coverage data for each 100-m^2 salvage cell are available upon request.

Most of Subarea F was shallow, with water depths ranging from <1 foot to 5 feet during salvage efforts (Table 4). The deepest areas were found in block F9, near the confluence with Subarea E (Fig. 3).

Water column visibility was poor throughout most of Subarea F and typically ranged from 15 to 30 cm, precluding visual searches for mussels. The poor visibility was likely due to slower flows in Subarea F (as compared to Subarea E) and the dominance of fine-grained substrate that was commonly suspended in the water column.

Within Subarea F, 59 live mussels representing six species were salvaged and relocated (Table 5; Figs. 5a–5c). White Heelsplitter was the most abundant and made up nearly 80%of the live mussels found in Subarea F. Over half of the mussels found in Subarea F were found in block F7, near the upstream end of Subarea F (Figs. 5a–5c). Subarea F is the only subarea in which Paper Pondshell (*Utterbackia imbecillis*), a species of special concern, was found.

4.2.3 Subarea G

The entire Subarea G mussel salvage footprint (2,023 m^2 total) was searched for mussels in 2020 (Fig. 3). Silt and muck were the most common substrate types in

Subarea G, with silt depth sometimes exceeding 18 inches. Submerged and floating aquatic vegetation was abundant and dense, particularly on the western side of mussel salvage block G1 (Fig. 3).

Subarea G was also shallow, with water depths ranging from <1 foot to 2.6 feet during salvage efforts (Table 6). Parts of Subarea G were found to be nearly dry, or with very little water, late in the summer after mussel salvage efforts had taken place.

Water column visibility in Subarea G was similar to that of Subarea F and typically ranged from 15 to 30 cm, precluding visual searches for mussels. The poor visibility was likely due to slower flows in Subarea G (as compared to Subarea E) and the dominance of fine-grained substrate that was commonly suspended in the water column.

Four live mussels representing two species, White Heelsplitter and Giant Floater (*Pyganodon grandis*), were salvaged and relocated from Subarea G (Table 7; Figs. 5a–5c). All of the mussels were found in block G2, which had more sand and less aquatic vegetation and silt than block G1 (Table 6).

4.3 Relocation Area

The MDNR-approved relocation area used for Subarea E, F, and G mussels (Fig. 4) was most similar in substrate composition to Subarea E. Sand and gravel were the most common substrate types in the relocation area, water depth ranged from <1 foot to 6 feet (Table 8) and was consistent in 2020 and 2021. Visibility was similar to Subarea E, typically in the 50–75-cm range. Twelve Muckets were found during qualitative searches in and around the relocation area.

4.4 Post-Relocation Monitoring

Post-relocation monitoring is required to assess survival of relocated mussels when state- or federally listed species are found. Neither state- nor federally listed mussels were found in Area 4, Subareas E, F, and G, so post-relocation monitoring of the salvaged and relocated mussels is not planned.

4.5 Conclusions

The Area 4, Subarea E, F, and G mussel salvage efforts detailed in this report were conducted in accordance with Michigan’s mussel protocol and the Mussel Work Plan (Appendix A). All areas with suitable mussel habitat were searched unless excluded due to safety concerns (e.g., swift current, underwater obstructions, elevated PCB

concentrations). Mussel survey and identification was conducted by trained and experienced mussel surveyors and biologists.

One hundred ninety-six (196) mussels were salvaged from Area 4, Subareas E, F, and G and relocated upstream in 2020 and 2021. All mussel species found were previously documented in the Kalamazoo River during prior mussel surveys conducted in 2001 (Mulcrone and Mehene, 2001). Mucket and White Heelsplitter were the most abundant species found at two locations near the Trowbridge Dam (Table 3 in Mulcrone and Mehne, 2001). These species were also the most abundant species found in Area 4 Subareas E, F, and G (Table 1). Shells from all species found in 2020 and 2021 were also found in the Kalamazoo River during a 2010 mussel shell search conducted by MNFI (MNFI, 2010).

The mussel community documented in Subareas E, F, and G was also generally consistent with results of mussel salvage efforts conducted in Area 3 of the Kalamazoo River in 2016–2017 (ESI, 2016 and 2018), with seven of the nine species found in Area 4 in 2020 also being found in Area 3 in 2016–2017. Mucket and White Heelsplitter were again the most abundant species found during the 2016–2017 Area 3 survey and relocation. Two species, Giant Floater and Paper Pondshell, were found in Area 4 during 2020 salvage but were not found during ESI's Area 3 salvage efforts. Low numbers of Plain Pocketbook (*Lampsilis cardium*) and Ellipse (*Venustaconcha ellipsiformis*) were documented in Area 3 but were not found in Area 4 in 2020 or 2021. These species differences can likely be attributed to substantial differences in flow and habitat in Subareas E, F, and G of Area 4 as compared with the Area 3 locations surveyed in 2016–2017. Area 4 retains some "impoundment-like" characteristics, particularly in Subareas F and G, which are highly depositional and heavily vegetated, particularly in late summer. These conditions are not ideal for mussels, thus it is not surprising the mussel community found in Subareas F and G was dominated by White Heelsplitter, a mussel species that is regularly found in slow-flowing (or lentic) waters and is "common below sewage outfalls and impoundments" (Watters et al, 2009).

Overall, relatively low mussel abundance was documented throughout Subareas E, F, and G. The low abundance may be driven by variable flow conditions and generally poor mussel substrate in the lower stretches of Area 4, particularly in Subareas F and G. Subareas F and G are subject to substantial water level fluctuations throughout the summer, with portions of those subareas drying out in late summer. Substrate in Subareas F and G is dominated by silt and muck and is not as diverse as substrate in Subarea E.

Nearly 68% (133/196) of the mussels salvaged came from Subarea E, where the highest quality mussel substrate (i.e., heterogeneous and stable) was documented, particularly in the lower half of Subarea E downstream of the confluence with Subarea F. Fewer mussels were found in the upper half of Subarea E, where highly mobile sand (homogeneous and unstable), generally considered poor substrate for mussels due to its instability, was dominant and can clearly be seen in the aerial images in Figs. 1 and 2 (blocks E5–E7).

Bottom substrates varied slightly within Subarea E between 2020 and 2021, with an exception being the LDB and middle channel portions of the lower part of Subarea E, downstream of the confluence of Subarea F. In that stretch, upwards of 24 inches of silt and fine-grained sediment had deposited in 2021. This substrate had not been felt nor observed in 2020 during prior reconnaissance or mussel salvage work. Deposition of sediment can adversely impact mussel populations (Goldsmith et al., 2021). These areas were determined to be devoid of mussels based on the high mobility and thickness of this material; preliminary searches resulted in no mussels found. Determining the source (and timing) of those deposits is beyond the scope of this mussel salvage report.

The relocation area utilized during the Area 4, Subarea E, F, and G mussel salvage was suitable for mussels based on the presence of live mussels throughout the area, a diversity of flows (slow and fast), and coverage of sand and gravel (Table 8). A small, vegetated island and river bend just upstream of the relocation area helps to create diversity in flow and substrate. The fish community in the relocation area is expected to be similar to the fish community found in Subarea E. These factors should maximize survival of the mussels relocated during the Area 4, Subarea E, F, and G mussel salvage efforts.

5. References

AECOM (2019). “Trowbridge Dam Removal – Phase 1A, Basis of Design Report.” Prepared for Michigan Department of Natural Resources. May 30, 2019.

ESI (2016). “Freshwater Mussel (*Unionidae*) Relocations in the Kalamazoo River for The Allied Paper, Inc. / Portage Creek Kalamazoo River Superfund Site Project in Allegan County, Michigan.” Prepared for Amec, Foster, Wheeler. December 30, 2016.

ESI (2018). “Freshwater Mussel (*Unionidae*) Relocations in the Kalamazoo River for The Allied Paper, Inc. / Portage Creek Kalamazoo River Superfund Site Project in Allegan County, Michigan. Prepared for Amec, Foster, Wheeler. March 8, 2018.

GEI (2020). “Mussel Work Plan, Rev. 1. OU5 Area 4 Time-Critical Removal Action Allied Paper/Portage Creek/Kalamazoo River Superfund Site.” Prepared for Kalamazoo Ri8ver Areas 2, 3, and 4 Remediation LLC. June 1, 2020.Goldsmith AM, Jaber F, Ahmari H, et al. (2021). Clearing up cloudy waters: A review of sediment impacts to unionid freshwater mussels. Environmental Reviews 29:100–108.

Hanshue S, Rathbun J, Badra P, et al. (2021). Michigan Freshwater Mussel Survey Protocols and Relocation Procedures for Rivers and Streams. May 2021.

Metcalfe-Smith J, MacKenzie A, Carmichael I, et al. (2005). *Photo Field Guide to the Freshwater Mussels of Ontario*. St. Thomas ON: St. Thomas Field Naturalist Club.

MNFI (2010). “Mussel Shell Survey Report: Kalamazoo River Unionid Mussel Shell Survey in the Marshall and Battle Creek Area, October 2010.” Prepared for U.S. Department of Interior, U.S. Fish and Wildlife Services and Kalamazoo River Enbridge Line 6B Oil Spill Trustee Council.

Mulcrone R S and Mehne C. (2001). “Freshwater mussels of the Kalamazoo River, Michigan, from Battle Creek to Saugatuck.” Prepared for U.S. Department of Interior, U.S. Fish and Wildlife Services, East Lansing Field Office, East Lansing, Michigan.

Mulcrone R and Rathbun J. (2018). *Pocket Field Guide to the Freshwater Mussels of Michigan.* Michigan Department of Natural Resources.

Smith DR (2006). Survey design for detecting rare freshwater mussels. J. N. Am. Benthol. Soc. 2006, 25(3): 701–711.

Watters GT, Hoggarth MA, Stansbery DH (2009). *The Freshwater Mussels of Ohio.* Columbus: The Ohio State University Press.

USFWS (2020). Telephone conversation with Jessica Pruden (USFWS), Ryan Holem (GEI), and Stu Kogge (GEI). February 24, 2020.

Tables

Table 1. 2020-2021 Area 4 Mussel Salvage Results Summary by Subarea

Species	Common Name	MI Status[1]	2020 E	2020 F[2]	2020 G[2]	2021 E	Area 4 Total
Actinonaias ligamentina	Mucket	-	49	0	0	16	**65**
Alasmidonta marginata	Elktoe	SC	7	0	0	5	**12**
Fusconaia flava	Wabash pigtoe	-	2	1	0	3	**6**
Lampsilis siliquoidea	Fatmucket	-	2	2	0	0	**4**
Lasmigona complanata	White heelsplitter	-	21	47	3	11	**82**
Lasmigona costata	Fluted-shell	SC	0	0	0	1	**1**
Pyganodon grandis	Giant floater	-	3	6	1	0	**10**
Strophitus undulatus	Strange floater	-	7	2	0	6	**15**
Utterbackia imbecillis	Paper pondshell	SC	0	1	0	0	**1**
	Total Mussels		**91**	**59**	**4**	**42**	**196**

[1] Status as of 2021: SC = Special Concern

[2] Mussel Salvage Completed in 2020

Prepared by D. Kowalski 12/16/2021
Checked by R. Holem 12/22/2021

Table 2. 2020-2021 Subarea E Substrate

Salvage Block	Depth (ft)[1]		Substrate Type Coverage (%)[1]									
	Ave	Max	Muck	Silt	Detritus	Sand	Gravel	Cobble	Boulder	Hardpan	Bedrock	Artificial
E1	1.8	2.5	0	10	0	90	0	0	0	0	0	0
E2	3.0	5.8	0	19	1	40	8	7	4	21	0	0
E3	3.4	8.2	0	15	0	49	9	6	1	21	0	0
E4	2.6	8.0	0	44	0	54	1	1	0	1	0	0
E5	1.8	4.3	0	7	0	84	2	4	1	1	0	0
E6	1.0	2.0	0	0	0	100	0	0	0	0	0	0
E7	2.0	3.0	0	0	0	100	0	0	0	0	0	0
E8	1.0	2.0	0	70	0	0	0	0	0	30	0	0
E9	2.1	3.5	0	35	0	63	0	0	0	3	0	0
E10	2.9	4.8	0	7	1	85	7	0	0	0	0	0
E11	3.1	4.6	0	24	6	50	5	12	0	3	0	0
Subarea E	**2.2**	**8.2**	**0**	**21**	**1**	**65**	**3**	**3**	**1**	**7**	**0**	**0**

[1] ft = feet; Ave = average; Max = maximum

[2] Average coverage values across all cells surveyed in a block

Prepared by D. Kowalski 12/16/2021
Checked by R. Holem 12/22/2021

Table 3a. 2020 Subarea E Mussels Salvaged

Species	Common Name	MI Status[1]	Salvage Block							Total Mussels
			E2	E4	E5	E6	E7	E10	E11	
Actinonaias ligamentina	Mucket	-	13	1	8	0	0	0	27	**49**
Alasmidonta marginata	Elktoe	SC	4	0	3	0	0	0	0	**7**
Fusconaia flava	Wabash pigtoe	-	2	0	0	0	0	0	0	**2**
Lampsilis siliquoidea	Fatmucket	-	2	0	0	0	0	0	0	**2**
Lasmigona complanata	White heelsplitter	-	8	0	6	0	0	4	3	**21**
Lasmigona costata	Fluted-shell		0	0	0	0	0	0	0	**0**
Pyganodon grandis	Giant floater	-	1	0	2	0	0	0	0	**3**
Strophitus undulatus	Strange floater	-	0	1	6	0	0	0	0	**7**
	Total Mussels		**30**	**2**	**25**	**0**	**0**	**4**	**30**	**91**

[1] Status as of 2021: SC = Special Concern; T = Threatened; E = Endangered; federally-listed mussels were not found

Table 3b. 2021 Subarea E Mussels Salvaged

Species	Common Name	MI Status[1]	Salvage Block								Total Mussels
			E1	E2	E3	E4	E5	E8	E9	E11	
Actinonaias ligamentina	Mucket	-	0	9	3	0	2	0	1	1	**16**
Alasmidonta marginata	Elktoe	SC	0	3	1	0	1	0	0	0	**5**
Fusconaia flava	Wabash pigtoe	-	0	0	1	0	2	0	0	0	**3**
Lampsilis siliquoidea	Fatmucket	-	0	0	0	0	0	0	0	0	**0**
Lasmigona complanata	White heelsplitter	-	0	1	4	0	1	0	5	0	**11**
Lasmigona costata	Fluted-shell		0	1	0	0	0	0	0	0	**1**
Pyganodon grandis	Giant floater	-	0	0	0	0	0	0	0	0	**0**
Strophitus undulatus	Strange floater	-	0	2	0	0	3	1	0	0	**6**
	Total Mussels		**0**	**16**	**9**	**0**	**9**	**1**	**6**	**1**	**42**

[1] Status as of 2021: SC = Special Concern; T = Threatened; E = Endangered; federally-listed mussels were not found

Prepared by D. Kowalski 12/16/2021
Checked by R. Holem 12/22/2021

Table 4. 2020 Subarea F Substrate

Salvage Block	Depth (ft)[1]		Substrate Type Coverage (%)[1,2]									
	Avg	Max	Muck	Silt	Detritus	Sand	Gravel	Cobble	Boulder	Hardpan	Bedrock	Artificial
F1	1.3	1.9	0	71	7	9	2	1	0	0	0	0
F2	1.0	1.7	0	82	1	15	2	0	0	0	0	0
F3	1.1	1.8	0	94	1	6	0	0	0	0	0	0
F4	1.3	1.9	0	73	13	11	0	0	0	0	0	0
F5	1.1	1.6	3	93	1	4	0	0	0	0	0	0
F6	1.6	2.1	0	90	1	9	0	0	0	0	0	0
F7	1.7	2.3	0	72	2	22	0	0	0	1	0	0
F8	1.3	1.9	0	79	4	16	0	0	0	0	0	0
F9	3.5	5.0	0	70	5	20	0	5	0	0	0	0
Subarea F	**1.5**	**2.2**	**0**	**80**	**4**	**12**	**0**	**1**	**0**	**0**	**0**	**0**

[1] ft = feet; Ave = average; Max = maximum

[2] Average coverage values across all cells surveyed in a block

[3] Dense macrophytes present in substantial portions of Subarea F

Prepared by D. Kowalski 12/16/2021
Checked by R. Holem 12/22/2021

Table 5. 2020 Subarea F Mussels Salvaged

Species	Common Name	MI Status[1]	Salvage Block									Total Mussels
			F1	F2	F3	F4	F5	F6	F7	F8	F9	
Fusconaia flava	Wabash pigtoe	-	1	0	0	0	0	0	0	0	0	**1**
Lampsilis siliquoidea	Fatmucket	-	0	0	0	0	1	0	1	0	0	**2**
Lasmigona complanata	White heelsplitter	-	3	0	0	4	13	1	23	1	2	**47**
Pyganodon grandis	Giant floater	-	1	0	0	0	0	0	5	0	0	**6**
Strophitus undulatus	Strange floater	-	0	0	0	0	0	1	1	0	0	**2**
Utterbackia imbecillis	Paper pondshell	SC	0	0	0	0	0	1	0	0	0	**1**
	Total Mussels		**5**	**0**	**0**	**4**	**14**	**3**	**30**	**1**	**2**	**59**

[1] Status as of 2021: SC = Special Concern; T = Threatened; E = Endangered; federally-listed mussels were not found

Prepared by D. Kowalski 12/16/2021
Checked by R. Holem 12/22/2021

Table 6. 2020 Subarea G Substrate

Salvage Block	Depth (ft)[1]		Substrate Type Coverage (%)[1,2]									
	Avg	Max	Muck	Silt	Detritus	Sand	Gravel	Cobble	Boulder	Hardpan	Bedrock	Artificial
G1	1.3	2.1	56	36	2	6	0	0	0	0	0	0
G2	1.7	2.6	0	16	3	45	0	0	0	36	0	0
Subarea G	**1.5**	**2.3**	**28**	**26**	**2**	**26**	**0**	**0**	**0**	**18**	**0**	**0**

[1] ft = feet; Ave = average; Max = maximum

[2] Average coverage values across all cells surveyed in a block

[3] Dense macrophytes present in substantial portions of Subarea G

Prepared by D. Kowalski 12/16/2021
Checked by R. Holem 12/22/2021

Table 7. 2020 Subarea G Mussels Salvaged

Species	Common Name	MI Status[1]	Survey Block		Total Mussels
			G1	G2	
Lasmigona complanata	White heelsplitter	-	0	3	**3**
Pyganodon grandis	Giant floater	-	0	1	**1**
		Total Mussels	**0**	**4**	**4**

[1] Status as of 2021: SC = Special Concern; T = Threatened; E = Endangered; federally-listed mussels not found

Prepared by D. Kowalski 12/16/2021
Checked by R. Holem 12/22/2021

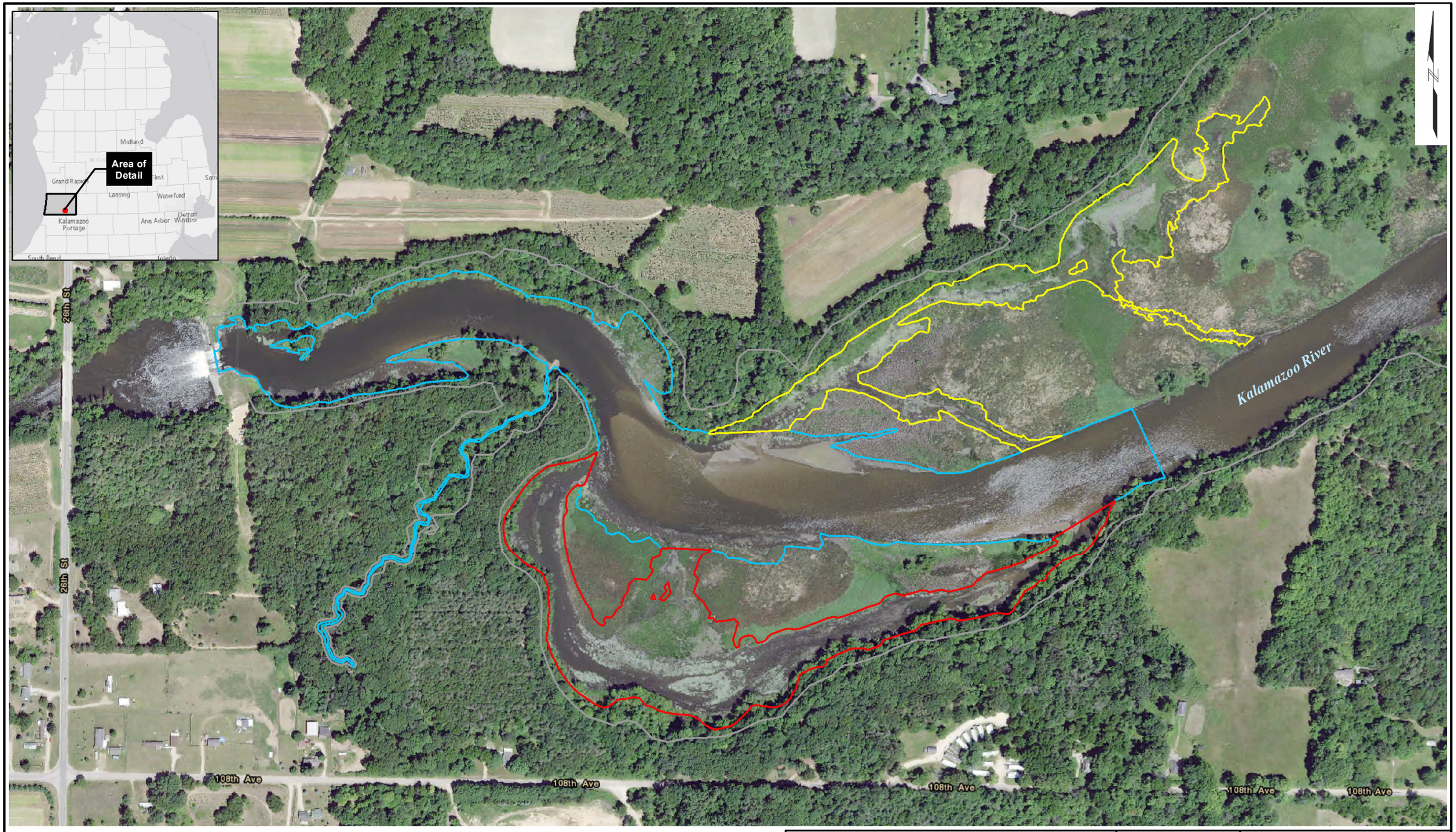
Table 8. 2020-2021 Relocation Area Substrate[1]

Depth (ft)		Substrate Type Coverage (%)									
Avg	Max	Muck	Silt	Detritus	Sand	Gravel	Cobble	Boulder	Hardpan	Bedrock	Artificial
4.0	6.0	0	0	0	65	25	10	0	0	0	0

[1] Numerous live Mucket and shells of other species were found in relocation area during qualitative searches

Prepared by D. Kowalski 12/16/2021
Checked by R. Holem 12/22/2021

Figures



Area 4 Boundary
Subarea E
Subarea F
Subarea G

*Sites are approximated and will be sized in accordance with number of mussels found.

0 175 350
SCALE, FEET

OU5 Allied Paper/Portage Creek/Kalamazoo River Superfund Site
Area 4 TCRA - Allegan County, Michigan

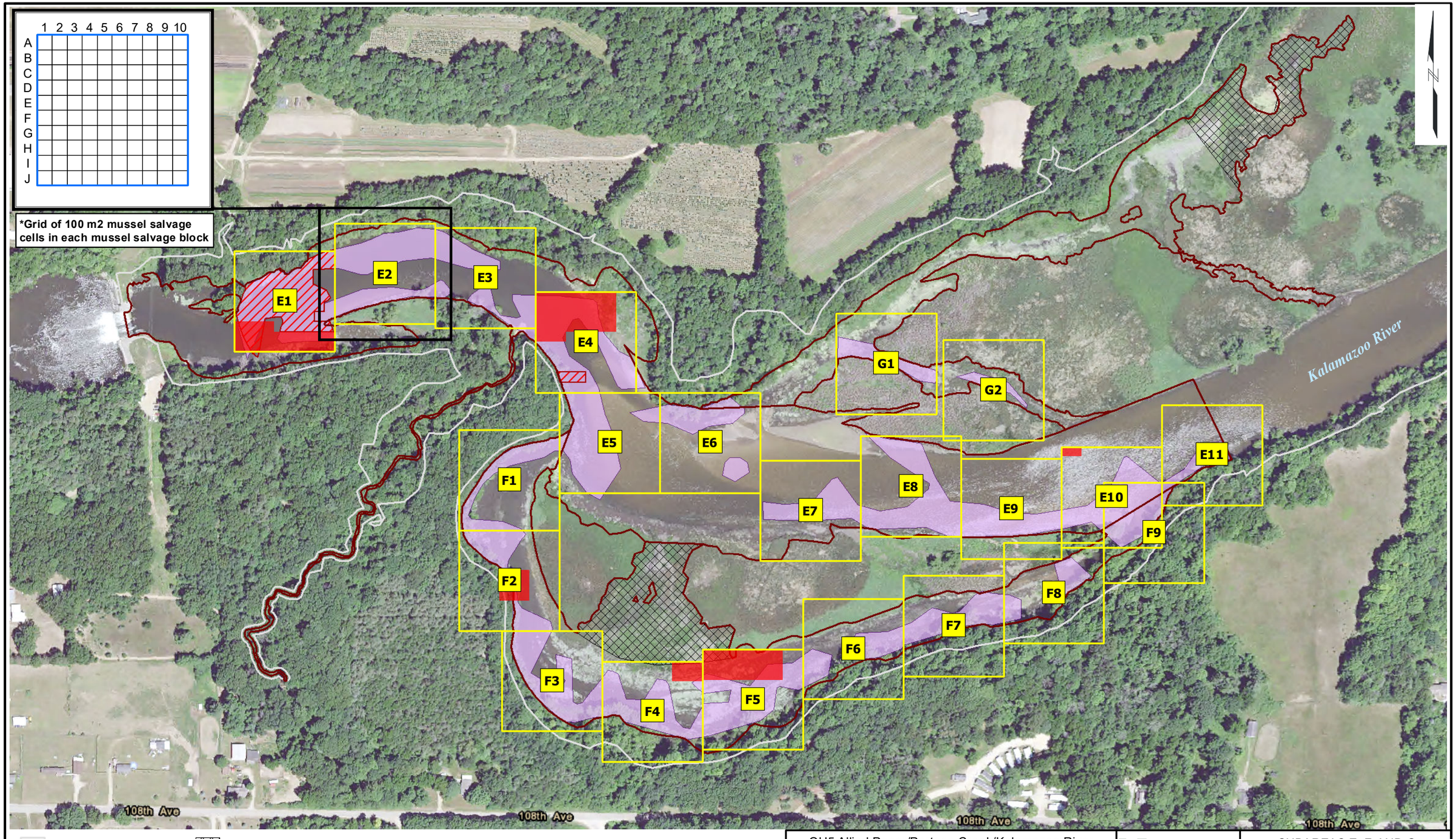
Kalamazoo River Areas 2, 3, and 4 Remediation LLC

Kalamazoo river cleanup group
AREAS 2, 3 AND 4 TCRA

AREA 4
SUBAREAS E, F, AND G

Project 2000273 | November 2021 | Fig. 1

\\Sac1s-fs01\GIS\Projects\2000273_Kalamazoo_River_Cleanup_Program\GIS\A4_Mussels\2021 Mussel Report\211118_Figure1.mxd



OU5 Allied Paper/Portage Creek/Kalamazoo River Superfund Site
Area 4 TCRA - Allegan County, Michigan

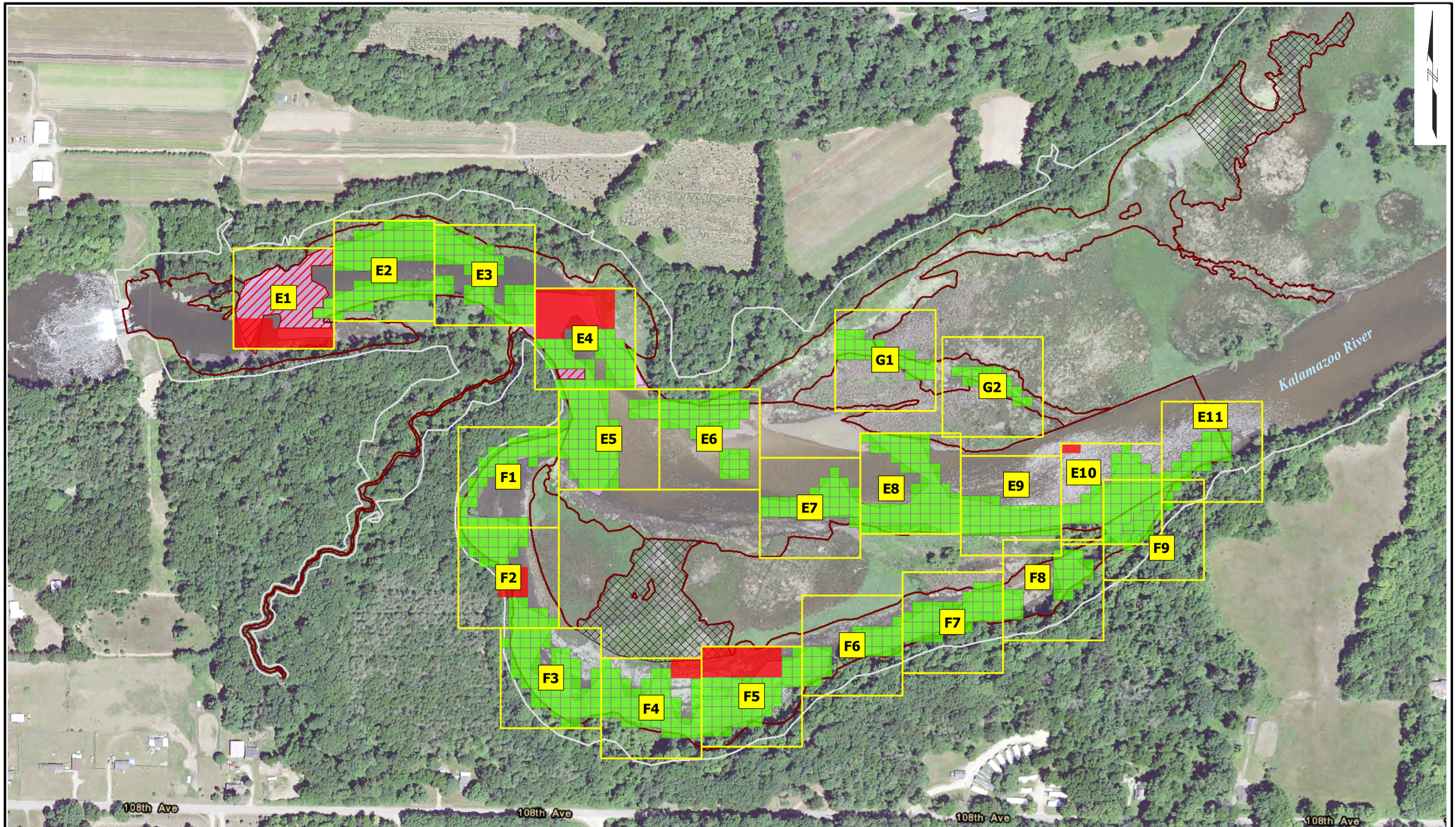
Kalamazoo River Areas 2, 3, and 4 Remediation LLC

Kalamazoo river cleanup group
AREAS 2, 3 AND 4 TCRA

SUBAREAS E, F, AND G
SUITABLE MUSSEL HABITAT
MUSSEL SALVAGE
BLOCKS AND CELLS

Project 2000273 | December 2021 | Fig. 2

\\Sac1s-fs01\GIS\Projects\2000273_Kalamazoo_River_Cleanup_Program\GIS\A4_Mussels\2021 Mussel Report\211118_Figure2.mxd



Area 4 Boundary
Area 4 Subarea Boundary
Suitable Mussel Habitat
Wetland/Emergent Vegetation
Mussel Salvage Block
Mussel Salvage Completed 2020/2021
No Salvage (Elevated PCB Levels)
No Salvage (Unsafe Survey Conditions)

0 150 300
SCALE, FEET

OU5 Allied Paper/Portage Creek/Kalamazoo River Superfund Site
Area 4 TCRA - Allegan County, Michigan

Kalamazoo River Areas 2, 3, and 4 Remediation LLC

kalamazoo river cleanup group
AREAS 2, 3 AND 4 TCRA

SUBAREAS E, F, AND G
MUSSEL SALVAGE STATUS

Project 2000273 | December 2021 | Fig. 3

\\Sac1s-fs01\GIS\Projects\2000273_Kalamazoo_River_Cleanup_Program\GIS\A4_Mussels\2021 Mussel Report\211122_Figure3.mxd

Area 4 Boundary
Subarea A Boundary
2021 Mussel Relocation Area

*Sites are approximated and will be sized in accordance with number of mussels found.

0 100 200
SCALE, FEET

OU5 Allied Paper/Portage Creek/Kalamazoo River Superfund Site
Area 4 TCRA - Allegan County, Michigan

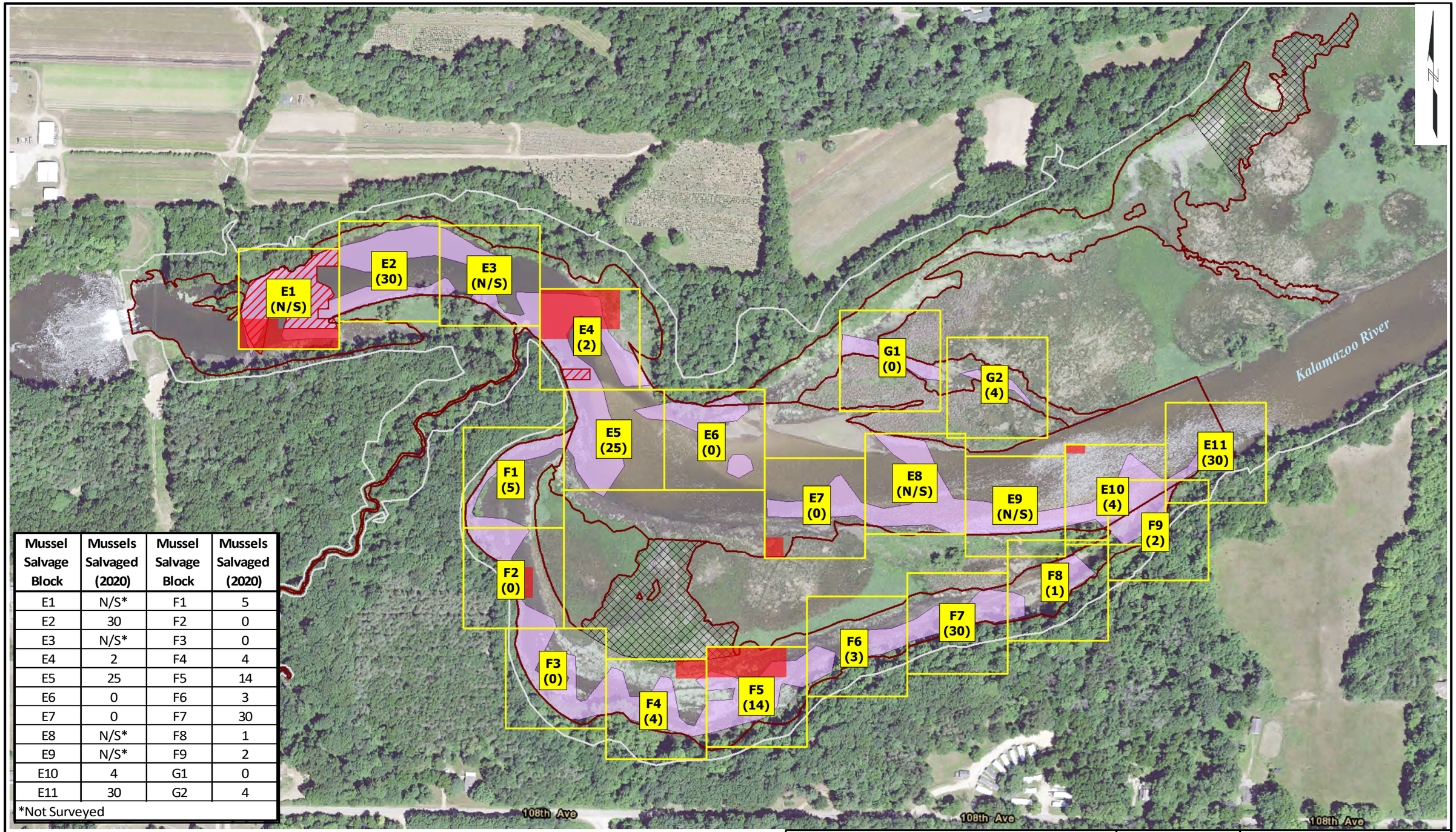
Kalamazoo River Areas 2, 3, and 4 Remediation LLC

Kalamazoo river cleanup group
AREAS 2, 3 AND 4 TCRA

2020-2021 AREA 4
MUSSEL RELOCATION AREA

Project 2000273 | November 2021 | Fig. 4

\\Sac1s-fs01\GIS\Projects\2000273_Kalamazoo_River_Cleanup_Program\GIS\A4_Mussels\2021 Mussel Report\211122_Figure4.mxd



Mussel Salvage Block	Mussels Salvaged (2020)	Mussel Salvage Block	Mussels Salvaged (2020)
E1	N/S*	F1	5
E2	30	F2	0
E3	N/S*	F3	0
E4	2	F4	4
E5	25	F5	14
E6	0	F6	3
E7	0	F7	30
E8	N/S*	F8	1
E9	N/S*	F9	2
E10	4	G1	0
E11	30	G2	4

*Not Surveyed

Area 4 Boundary
Area 4 Subarea Boundary
Suitable Mussel Habitat
Mussel Salvage Block
Wetland/Emergent Vegetation
No Salvage (Elevated PCB Levels)
No Salvage (Unsafe Survey Conditions)

E5 (25) — Mussel Salvage Block / Mussels Salvaged (2020)

0 150 300
SCALE, FEET

OU5 Allied Paper/Portage Creek/Kalamazoo River Superfund Site
Area 4 TCRA - Allegan County, Michigan

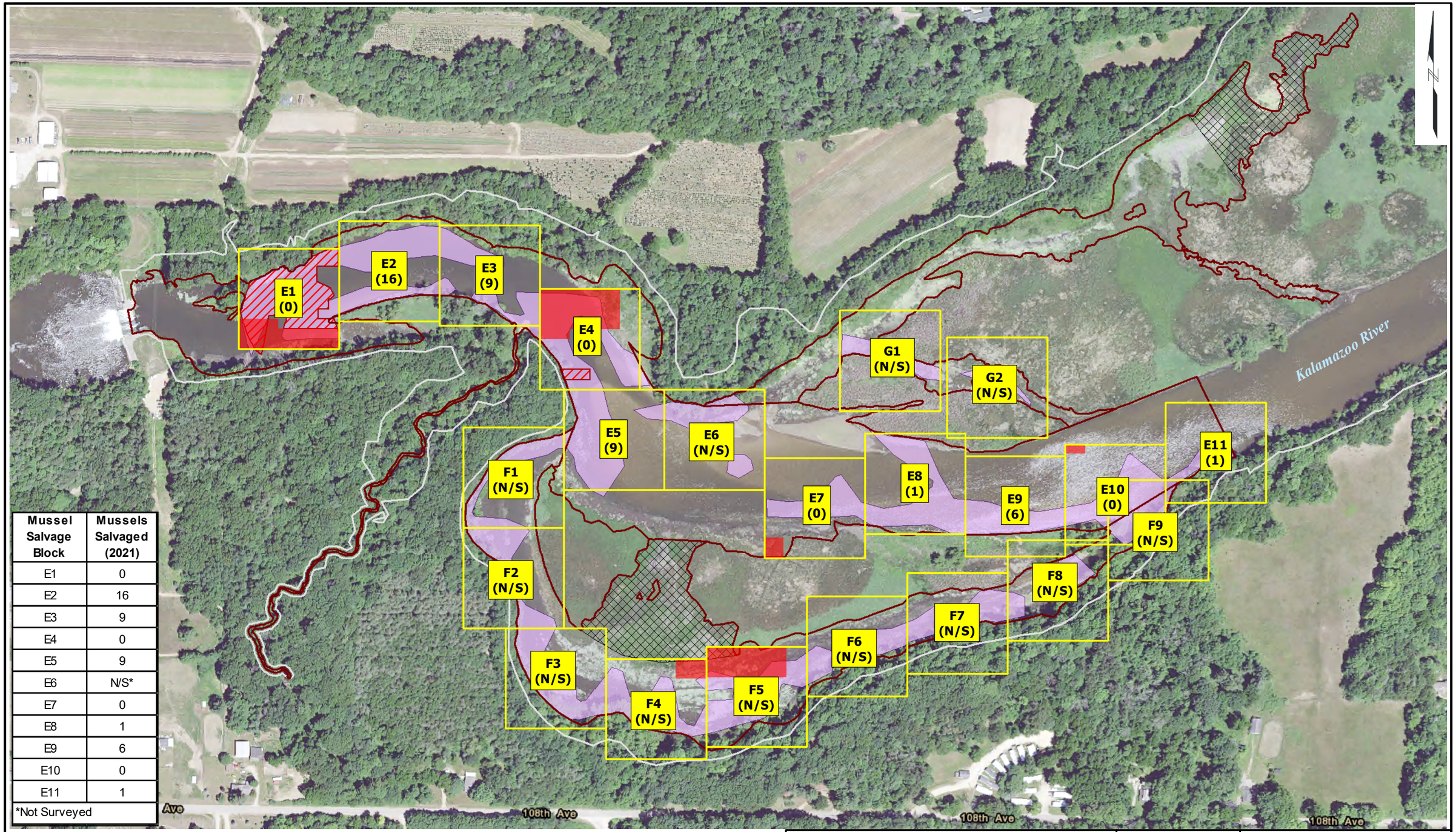
Kalamazoo River Areas 2, 3, and 4 Remediation LLC

Kalamazoo river cleanup group
AREAS 2, 3 AND 4 TCRA

2020 MUSSELS SALVAGED PER BLOCK

Project 2000273 | November 2021 | Fig. 5a

\\Sac1s-fs01\GIS\Projects\2000273_Kalamazoo_River_Cleanup_Program\GIS\A4_Mussels\2021 Mussel Report\211122_Figure5.mxd



Mussel Salvage Block	Mussels Salvaged (2021)
E1	0
E2	16
E3	9
E4	0
E5	9
E6	N/S*
E7	0
E8	1
E9	6
E10	0
E11	1
*Not Surveyed	

Area 4 Boundary
Area 4 Subarea Boundary
Suitable Mussel Habitat
Mussel Salvage Block
Wetland/Emergent Vegetation
No Salvage (Elevated PCB Levels)
No Salvage (Unsafe Survey Conditions)

E5 (25) — Mussel Salvage Block; Mussels Salvaged (2021)

0 150 300
SCALE, FEET

OU5 Allied Paper/Portage Creek/Kalamazoo River Superfund Site
Area 4 TCRA - Allegan County, Michigan

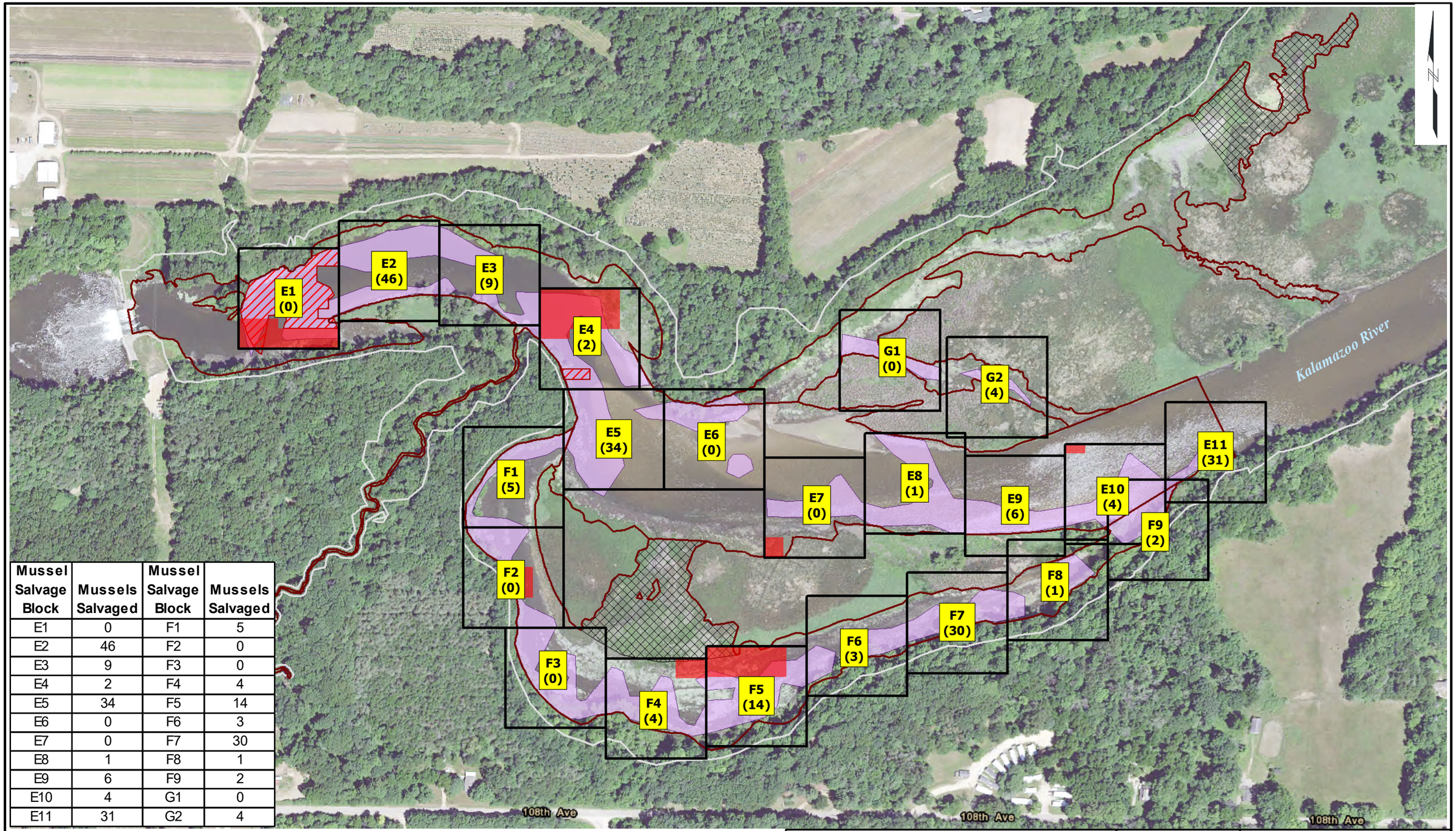
Kalamazoo River Areas 2, 3, and 4 Remediation LLC

Kalamazoo river cleanup group
AREAS 2, 3 AND 4 TCRA

2021 MUSSELS SALVAGED PER BLOCK

Project 2000273 | November 2021 | Fig. 5b

\\Sac1s-fs01\GIS\Projects\2000273_Kalamazoo_River_Cleanup_Program\GIS\A4_Mussels\2021 Mussel Report\211122_Figure5.mxd



Mussel Salvage Block	Mussels Salvaged	Mussel Salvage Block	Mussels Salvaged
E1	0	F1	5
E2	46	F2	0
E3	9	F3	0
E4	2	F4	4
E5	34	F5	14
E6	0	F6	3
E7	0	F7	30
E8	1	F8	1
E9	6	F9	2
E10	4	G1	0
E11	31	G2	4

Area 4 Boundary
Area 4 Subarea Boundary
Suitable Mussel Habitat
No Salvage (Elevated PCB Levels)
Wetland/Emergent Vegetation
Mussel Salvage Block
No Salvage (Unsafe Survey Conditions)
E5 (25) — Mussel Salvage Block / Mussels Salvaged (20/21)

0 150 300
SCALE, FEET

OU5 Allied Paper/Portage Creek/Kalamazoo River Superfund Site
Area 4 TCRA - Allegan County, Michigan

Kalamazoo River Areas 2, 3, and 4 Remediation LLC

Kalamazoo river cleanup group AREAS 2, 3 AND 4 TCRA

2020-2021 MUSSELS SALVAGED PER BLOCK

Project 2000273 | November 2021 | Fig. 5c

\\Sac1s-fs01\GIS\Projects\2000273_Kalamazoo_River_Cleanup_Program\GIS\A4_Mussels\2021 Mussel Report\211203_Figure5d.mxd

Appendix A – Area 4 TCRA Mussel Work Plan, Rev 1.0

Kalamazoo river cleanup group
AREAS 2, 3 AND 4 TCRA

April 13, 2020
Revised June 1, 2020

Mussel Work Plan, Rev. 1

OU5 Area 4 Time-Critical Removal Action
Allied Paper/Portage Creek/
Kalamazoo River Superfund Site

Prepared for:
Kalamazoo River Areas 2, 3, and 4 Remediation LLC

GEI Consultants

Mussel Work Plan, Rev. 1

OU5 Area 4 Time-Critical Removal Action
Allied Paper/Portage Creek/
Kalamazoo River Superfund Site

Prepared for:
Kalamazoo River Areas 2, 3, and 4 Remediation LLC
864 Spring Street NW
Atlanta, Georgia 30308-1007

Prepared By:
GEI Consultants of Michigan, P.C.
3065 Akers Mill Road, Suite 235
Atlanta, GA 30339

April 13, 2020
Revised June 1, 2020

GEI Project No. 2000273

Table of Contents

Appendices

Abbreviations and Acronyms

CD	Consent Decree
°F	Degrees Fahrenheit
EPA	United States Environmental Protection Agency
GEI	GEI Consultants of Michigan, P.C.
m	Meters
LLC	Kalamazoo River Areas 2, 3, and 4 Remediation LLC
MDNR	Michigan Department of Natural Resources
NCR	NCR Corporation
OU	Operable Unit
PCBs	Polychlorinated biphenyls
PDI	Preliminary Design Investigation
SOP	Standard Operating Procedure
TCRA	Time-Critical Removal Action
TE	Threatened and Endangered
USFWS	United States Fish and Wildlife Service

1. Revision History

Issued By:	GEI Consultants of Michigan, P.C.

Document Revision Record

Issue No.	Date	Details of Revisions
1	6/1/2021	Included results of 2020 substrate and flow field reconnaissance

2. Introduction

GEI Consultants of Michigan, PC (GEI) is pleased to provide this Mussel Work Plan for Area 4 of Operable Unit 5 (OU5) of the Allied Paper/Portage Creek/Kalamazoo River Superfund Site (Site). This work will be performed by GEI on behalf of the Kalamazoo River Areas 2, 3, and 4 Remediation LLC (LLC), which NCR Corporation (NCR) formed to meet certain requirements of the Consent Decree (CD) between NCR Corporation, the United States Environmental Protection Agency (EPA), and the State of Michigan. The CD was lodged in December 2019 and, if approved by the Court, will require NCR to conduct response activities in Areas 2, 3, and 4 of Operable Unit 5 of the Allied Paper/Portage Creek/Kalamazoo River Superfund Site. Work activities mandated by the CD include: performance of a time-critical removal action (TCRA) in Area 4, remedial design and remedial action in Area 2, and, unless an opt-out is exercised, remedial design and remedial action in Area 3.

As part of the Area 4 TCRA remedial efforts, NCR will conduct a freshwater mussel survey and salvage effort ahead of the anticipated sediment removal actions. This Mussel Work Plan was developed to outline the tasks and procedures associated with these survey and salvage activities. This Mussel Work Plan was updated following reconnaissance efforts conducted in May 2020 and may be subject to further updates, pending assessment and evaluation of additional data obtained in implementing this Work Plan.

Michigan is one of several states with written protocol designed to guide mussel survey and relocation efforts within lotic (flowing) waters. Michigan's protocol, entitled "*Michigan Freshwater Mussel Survey Protocols and Relocation Procedures*" (MDNR et al., 2019, Version 2), hereafter referred to as "Michigan's mussel protocol", was designed for "projects whose potential impacts are limited spatially to a few hundred meters of river or less (e.g. streambed disturbance, or temporarily increased sedimentation), not for projects or events impacting multiple kilometers of river (e.g. chemical or oil spills, mussel kills, or large dredging projects)."

Michigan's mussel protocol and its applicability to the proposed scope of Area 4 TCRA remediation activities were discussed during a March 10, 2020 meeting with biologists from GEI Consultants of Michigan, P.C. (GEI) and the Michigan Department of Natural Resources (MDNR). General agreement was reached that the Area 4 TCRA mussel effort should be considered a mussel "salvage" project (and is hereafter referred to as such), rather than a mussel survey given the large-

scale dredging in advance of the removal of the Trowbridge Dam. As such, MDNR concurred that Michigan's mussel protocol does not apply to the mussel effort described in this document. In addition, agreement was reached during the meeting that mussel salvage efforts covered under this Mussel Work Plan should focus on Area 4, Subareas E, F, and G, (Figure 1) with any additional Area 4 mussel efforts (e.g., Subareas C and D, if necessary) captured under subsequent revised versions of this Mussel Work Plan.

Mussel species diversity and density in Area 4 is not known but is expected to be generally consistent with previous mussel relocation efforts conducted in Area 3 (OU5) of the Kalamazoo River (ESI, 2016, 2017, and 2018) and finding additional species is not expected (MDNR and GEI, 2020). Kalamazoo River mussel occurrence data will be reviewed in advance of the Area 4 mussel salvage effort and are expected to include, but may not be limited to, reports from Michigan Natural Features Inventory (MNFI; 2011), Mulcrone and Mehne (2001), and reports/theses (i.e., Barnett, 2015) produced from Dr. Daelyn A. Woolnough's laboratory at Central Michigan University.

This Mussel Work Plan outlines mussel salvage and relocation efforts proposed for 2020 and 2021 based upon substrate and mussel habitat characterization reconnaissance surveys completed in May 2020. At present it does not include salvage and relocation efforts that may be associated with the removal of Trowbridge Dam. Major goals of efforts described in this Mussel Work Plan include:

- Generate mussel habitat data (i.e., substrate types, stability, and distribution within the river) and an understanding of how it may relate to water depths and flows. This data can be used to minimize time spent in areas with low mussel density;
- To the extent possible, identify and focus on areas with a probable high density of mussels, with a particular emphasis on federal and state threatened and endangered (TE) mussel species; and
- Find and relocate (salvage) as many mussels as possible.

A preliminary sequence/timeline for efforts to be conducted under this Mussel Work Plan is as follows:

- Submit draft Mussel Work Plan to MDNR for review (March-April 2020; submitted and approved April 13, 2020);

- Conduct reconnaissance efforts in Area 4, Subareas E, F, and G, and potential mussel relocation areas (April-May 2020; completed May 2020);
- Submit revisions to the approved Draft Mussel Work Plan for review based upon completed reconnaissance efforts (end of May 2020);
- Conduct mussel salvage efforts in Area 4, Subareas E, F, and G (June - September 2020 and June–September 2021);
- Conduct post-relocation monitoring in selected mussel relocation areas (September-October 2020 and/or September–October 2021); and
- Generate mussel salvage summary report including recommendations for future mussel salvage efforts, if necessary (Fall/Winter 2020 and 2021).

3. Reconnaissance Efforts

Reconnaissance efforts focused on characterizing bottom substrates and assessing flows within the proposed remediation areas of Area 4 Subareas E, F, and G and the evaluation of relocation areas located further upstream within Area 4 Subarea A and previously remediated areas within Area 3 of the Kalamazoo River (Figures 1 and 2, respectively). These field reconnaissance assessments were conducted in May 2020 to identify areas with suitable and unsuitable substrates for freshwater mussels and areas of safe and unsafe flows for scuba divers to salvage any freshwater mussels present.

Reconnaissance efforts primarily focused on Area 4, Subareas E, F, and G where dredging may occur in in 2021 (MDNR and GEI, 2020). Reconnaissance efforts were also conducted in potential mussel relocation areas recommended by and discussed with MDNR. An overview of reconnaissance methods is described below with reconnaissance effort results summarized in Section 2.3.

3.1 Subarea E, F, and G Substrate/Habitat Characterization

A transect-based substrate evaluation was conducted throughout Subareas E, F, and G. Transects were spaced 25 meters (m) apart (Figure 3) unless substrate was clearly not suitable for mussels in which case transects were spaced further apart, which was the case in Subarea G. In each transect, substrate was characterized at multiple points via sediment “poling” and/or ponar grab samples. Poling was also conducted in between transects to evaluate for changes in substrate between transects. MDNR noted that substantial portions of Subarea E may be highly mobile sand, which is generally not suitable substrate for mussels (MDNR and GEI, 2020). MDNR also noted that Subarea G may not be inundated with water year-round so mussels may not be present in this area (MDNR and GEI, 2020). These conditions were assessed during the substrate evaluation.

At each transect point, data below were recorded:

- Water depth;
- Presence/absence of macrophytes and woody debris;
- Surface substrate type (e.g., sand, silt, gravel, cobble, boulder, detritus, hardpan, etc.); and

- Surface substrate characterization (e.g. stable, unstable, level of mobility, compacted, unconsolidated, etc.).

From this data, a determination as to the presence/absence of suitable (and unsuitable) mussel substrate/habitat at each transect point was made. The following substrate types and features were characterized as “unsuitable” for mussels:

- Bedrock/hardpan;
- Homogeneous, unstable, and highly mobile substrate such as sand and silt;
- Homogeneous, unstable, and relatively unconsolidated substrates such as soft mucks, clays, silts, and detrital matter in backwater areas; and
- Areas with dense coverage of large woody debris and/or detritus.

Each of the 368 transect points were identified as being either suitable or unsuitable substrate for freshwater mussels using criteria established above. Points of suitable substrate were combined into polygons (Figure 3). Results of the substrate/habitat characterization are summarized in Section 2.3.

3.2 Relocation Area Evaluation

GEI understands that relocation area(s) need to be selected to maximize survival and fitness of the relocated individuals, minimize risk to resident mussel fauna at the relocation site, and enable efficient monitoring of relocated mussels. The relocation area(s) should generally have the same habitat types as the salvage sites and evidence that live mussels are either present or could survive in the relocation area(s). Areas which currently support freshwater mussels and are not anticipated to be disturbed by future remediation activities (i.e., Area 4, Subarea A) or areas that have had site conditions remediated and improved upon will be considered areas that can be supportive of freshwater mussels. Hydraulic modeling data will be reviewed to confirm the relocation area(s) selected will not end up being dewatered once Trowbridge Dam is removed.

Three potential mussel relocation areas (Figure 2) were recommended for evaluation by MDNR (MDNR and GEI, 2020). Those areas were visited as part of the reconnaissance efforts and evaluated for suitable substrates and flows using similar techniques described in Section 2.1, but in lesser detail and without the use of transects. Evaluation of these areas also considered factors such as site access and overall size of area that would be suitable for mussel relocation. Results of the relocation area assessments are summarized in Section 2.3.4. No mussels will be

salvaged and relocated until relocation area(s) have been agreed upon by regulatory agencies.

3.3 Reconnaissance Results

Field reconnaissance efforts were conducted on May 4, 5, and 11, 2020 in Area 4 Subareas E, F, and G and in three potential relocation areas between Area 4 Subarea A and previously remediated subareas of Area 3 (Figures 1 and 2, respectively) Figures 3 and 4 illustrate the results, assessments, and evaluations of those efforts. A summary of reconnaissance effort findings is presented below.

3.3.1 Subarea E

Two hundred and five (205) points along 45 transects were evaluated in Subarea E (Figure 3). A summary of relevant Subarea E observations is provided in the bullets that follow:

- Water depth ranged from 0.3 – 3.5 m and visibility was generally 15-50 centimeters (cm).
- Water temperature ranged from 61-65°F.
- The highest quality mussel substrate was documented in the lower half of Subarea E where heterogeneous substrates were identified and included sand, gravel, and cobble (Figure 3).
- Homogenous unsuitable substrate, such as highly mobile sand, was regularly found in the upper half of Subarea E (Figure 3).
    - Areas with highly mobile sand as the dominant substrate type were eliminated from the salvage footprint (Figure 3).
- Flow velocities were fastest at the lower end of Subarea E with a maximum observed flow rate of 3.5 feet per second (fps). The slowest velocities were in the backwater areas and interior bends of the river where negligible flows were observed. Average flow velocity in Subarea E during the reconnaissance effort was 1.9 fps.
    - In accordance with OSHA regulation 1910.424, current velocities in excess of 1.7 fps require a diver to be line-tended. Velocities well in excess of 2.0 fps can create unsafe conditions for mussel salvage and determinations as to diver safety will be evaluated in the field at the time of field salvage efforts.
- Several transects near the bottom end of Subarea E had flow rates in excess of

4 fps and was close to the Trowbridge Dam. Due to swift currents, the boat could not be consistently held at Transect 1 to collect substrate data. These lower transects with their fast currents and proximity to the dam are unsafe for divers.

- Areas that exceeded these velocities were excluded from the salvage footprint and are depicted in red cross-hatching in Figure 3.

3.3.2 Subarea F

One hundred and sixteen (116) points along 34 transects were evaluated in Subarea F (Figure 3). A summary of relevant Subarea F observations is provided in the bullets that follow:

- Water depth ranged from 0.2 – 1.4 m and visibility was generally 15-30 cm.
- Water temperature ranged from 61-65°F.
- The highest quality substrate was documented in the lower half of Subarea F and along the left downstream bank where heterogeneous substrate included sand and gravel (Figure 3).
- The right downstream bank was typically unsuitable for mussels with mobile sand and unconsolidated silt and muck regularly found.
- Emergent vegetation bisects Subarea F from the main channel of the Kalamazoo River and is not suitable for mussels given very shallow depths and lack of flow between the main river channel and Subarea F.
- Flow velocity was most swift at the upper and lower ends of Subarea F with a maximum observed flow rate of 1.7 fps. Negligible flows were observed in backwater areas. Average flow velocity in Subarea F during the reconnaissance effort was 0.8 fps.
- Three transects at the upper end of Subarea F could not be reached due to shallow waters and downed trees blocking boat access to those transects. Therefore, those areas are currently labeled as being suitable substrate for mussels. Further reconnaissance or salvage efforts may determine those areas to be unsuitable substrates.

3.3.3 Subarea G

Forty-seven (47) points along 16 transects were evaluated in Subarea G (Figure 3). A summary of relevant Subarea G observations is provided in the bullets that follow:

- Water depth ranged from 0.3 – 1.2 m and visibility was generally 15-30 cm.
- Water temperature ranged from 61-65°F.
- Subarea G is primarily a backwater area dominated by unsuitable substrate consisting of unconsolidated silt, muck, and detrital deposits (Figure 3).
- Dense submergent and emergent aquatic vegetation was observed throughout Subarea G, with several transects towards the northeast end of Subarea G not reachable by boat due to water depths of less than six inches and dense vegetation.
- Flow velocity was most swift at the lower end of Subarea G with a maximum observed flow rate of 1.3 fps. Flows were generally negligible throughout most of Subarea G.

3.3.4 Relocation Area Evaluation

Three potential mussel relocation areas upstream of Area 4 Subareas E, F, and G were evaluated during the reconnaissance effort (Figure 2). A summary of relocation area observations is provided in the bullets that follow and the relocation area recommended for mussels salvaged in 2020 is shown in Figure 4:

- Relocation Area 1 was found to have multiple stretches with suitable mussel substrate including sand/gravel and gravel/cobble (Figure 4). Water depth in these stretches was generally four feet or less and current was acceptable for scuba diving. A small vegetated island and river bend in this area created diversity in flow and substrate, which will be of benefit if a diverse mussel assemblage is found in Subareas E, F, and G.
- Potential Relocation Areas 2 and 3 were further upstream and found to have less suitable substrate than Relocation Area 1, particularly in previously remediated areas where rock and boulders were very common. Current in these areas was much faster than Relocation Area 1 and would preclude the use of scuba gear in the majority of these areas.

For the reasons above, Relocation Area 1 (Figure 4) is recommended for relocation of mussels salvaged in 2020.

3.4 Sediment Characterization for PCB Analysis

Additional sediment characterization efforts are anticipated in 2020 as part of the Preliminary Design Investigation (PDI) sampling for polychlorinated-biphenyl (PCB) analysis in Area 4, Subareas E, F, and G. The sampling plan and timelines of the sediment PCB investigation are still under development. Surface sediment PCB data from 2014-2015 suggests some of the areas where suitable mussel substrate was documented may contain elevated levels of PCBs. Those data are being used to evaluate the potential human health risks from contacting sediment during mussel salvage efforts. If substantial risk is likely then further modifications to this work plan may be necessary.

4. Mussel Salvage and Relocation Methods

4.1 Mussel Collection

Mussel salvage efforts will focus only on areas where suitable substrate was documented (Figure 3) during the reconnaissance effort. Areas with unsuitable substrate will not be searched for mussels. In addition, salvage efforts will not be conducted in areas where current creates unsafe conditions as shown on Figure 3. Mussel salvage and relocation methods will be based on standardized methods presented in sources such as Michigan's 2019 mussel survey protocol (i.e. Strayer and Smith, 2003) and as discussed with MDNR (MDNR and GEI 2020).

GEI will use a moving transect method and/or cells, the latter of which would not exceed 100 m^2, to conduct the mussel salvage. Starting at the downstream most location of the proposed salvage area, a transect line will be established to begin gridding out survey cells for the salvage efforts. As salvage activities within cells are completed, the transect lines will be moved upstream and the gridding process will continue.

Viewing buckets and/or snorkeling will be used to search for mussels in the near-shore areas if water depths are less than 3 feet and visibility allows. Scuba divers will search all areas not accessible via viewing buckets or snorkeling. Scuba diving will be conducted by certified scuba divers operating in accordance with a GEI dive plan.

To locate mussels, a visual-tactile search of the surficial substrate will be conducted first, followed by excavation of the substrate to a depth of approximately six inches. Excavations may not be conducted in areas in which PCB concentrations suggest contact with sediment may pose a human health risk.

Based upon reconnaissance efforts, mussel search times (i.e., effort per square meter) will begin at 1 minute/meter^2 (min/m^2) and may be increased in areas with high mussel density or if small-bodied mussels are encountered. Search time will be decreased to 0.5 min/m^2 in areas where mussels are found in low density. Once a given area (e.g., a survey cell not to exceed 100 m^2) has been searched, that cell will be considered "cleared" and efforts will proceed to the next cell.

4.2 Mussel Handling

Live mussels will be extracted from the river and placed in flow-through containers (i.e., mesh bags, buckets with holes in them) kept out of the sunlight. Mussels will be identified by biologists with experience and training in the identification of Michigan mussel species. Mussels will be measured to the nearest millimeter using calipers. If a large number of mussels are found, a subset of the non-listed mussel species will be measured. All TE mussels will be measured. Representative photographs (i.e., left valve, right valve, dorsal view) of each species will be taken. Information such as the species, shell length, and marking/tagging information (if necessary) will be tracked by transect and/or cell.

4.3 Mussel Marking/Tagging

Mussel marking and/or tagging will not be required for non-listed mussels (MDNR and GEI, 2020). All TE mussels will be marked or tagged, whichever option is most effective based on factors such as the size and condition of mussels found and weather. If marking, waterproof pens would be utilized, while glue-on shellfish/bee tags would be used for tagging. Markings and tag numbers will be recorded to facilitate post-relocation monitoring efforts described further in Section 5.

4.4 Mussel Relocation

Mussel relocations will be conducted at the end of each day or concurrently with salvage efforts. During the relocation, live mussels will be transported to relocation sites in flow-through mesh bags or buckets, taking care to provide consistent fresh river water to the mussels and prevent mussel exposure to direct sunlight for extended periods of time. Mussels will be placed in relocation areas in the proper position (siphons up) in suitable habitat. Consistent with Michigan's mussel protocol for flowing waters, survey efforts will be halted, and personnel from the United States Fish and Wildlife Service (USFWS) notified, if a federally-listed mussel species is encountered. However, this is not expected based on the lack of federally-listed mussels in previous Kalamazoo River mussel surveys conducted by ESI (2016, 2017, and 2018) and personal communication with the USFWS (2020). If federally-listed mussels are found, those mussels will be temporarily held (i.e., not relocated upstream) and USFWS will be notified to discuss a path forward that will not impede the progress of mussel salvage efforts.

4.5 Permitting

This effort will require scientific collector's and TE species permits from MDNR. GEI will secure these permits, including MDNR-approved mussel relocation sites, prior to the initiation of any mussel salvage efforts. GEI currently possesses a USFWS federal mussel permit (Permit Number TE33374D-0) but has not been authorized to relocate federally-listed mussels from Area 4 because federally-listed mussels are not expected to be encountered (USFWS, 2020).

An MDNR Land Use Permit will also be required for mussel work. One Land Use Permit will cover all mussel activities (reconnaissance survey, salvage, relocation).

4.6 Mussel Collection Timelines

The typical timeframe for mussel relocation efforts in Michigan is June 1 – September 15 and mussel salvage efforts will commence once necessary permits have been secured. Surface water temperatures in Subareas E, F, and/or G were above 60°F during the May 2020 reconnaissance effort, which is well above the 50°F minimum water temperature listed in Michigan's mussel protocol. If necessary, the September 15 deadline may be extended per conversation with MDNR (MDNR and GEI, 2020).

4.7 Documentation

Documentation generated during and included as part of the salvage effort will include, but may not be limited to:

- Mapping of salvage and relocation areas using GPS units capable of sub-meter accuracy;
- Representative photographs of salvage efforts and photographs of all mussel species; and
- Recorded field condition details such as visibility during salvage efforts, survey techniques utilized (i.e., snorkel, viewing buckets, tactile (grubbing), weather conditions, substrate, etc.

5. Stranded Mussel Salvage

Any portion of Area 4 Subareas E, F, and G containing suitable mussel habitat that will end up dewatered and dry once Trowbridge Dam is removed may be subject to additional mussel salvage efforts in advance of, or in conjunction with, removal of the dam (MDNR and GEI, 2020). This effort would be scoped once additional hydraulic modeling has been completed and the timeline for the removal of Trowbridge Dam is better understood. GEI also understands that MDNR is currently developing protocol for the recovery of “stranded mussels” (i.e. mussels exposed during dewatering actions). MDNR has indicated they will share these protocols once they are ready for public review and that they may influence future mussel salvage efforts (MDNR and GEI, 2020).

6. Post-Relocation Monitoring

Salvaged TE mussels will be monitored using methods discussed with MDNR (MDNR and GEI 2020). Mussel density and diversity in Subareas E, F, and G is not known at this time, but it is assumed that several hundred mussels (perhaps more than 1,000), consisting primarily of non TE species, will be salvaged and relocated in 2020.

Mussel salvage efforts are expected to occur throughout the summer of 2020 and a monitoring event will be conducted no later than September 15, 2020. An effort to locate all marked or tagged TE mussels will be made and will include searching a buffered area to account for movement. Elevated post-relocation mortality (i.e., > 40 percent as noted in Michigan's Mussel Protocol) of relocated mussels (not each species) may indicate that conditions at the relocation site are inappropriate for long-term survival. If this occurs, MDNR will be contacted to determine what follow up action may be necessary. No long-term monitoring of relocated mussels is not planned for this project.

7. Reporting

A summary report will be developed that describes and summarizes the salvage and relocation efforts. The report will include an overview of methods used, summary of data collected, discussion of the findings, maps indicating general locations of the mussels found and their relocation zones, and supporting documentation such as photographs of the salvage and relocation areas and a list of all species of mussels observed. If the salvage effort extends beyond the 2020 season an additional summary report will be submitted.

8. References

Barnett, S., 2015. Fragmentation and Landscape-Mediated Effects on Freshwater Mussel Assemblages in the Lake Michigan Basin, Michigan, USA. M.S. Thesis – Central Michigan University. 2015.

ESI, Inc. 2016. Freshwater Mussel (Unionidae) Relocations in the Kalamazoo River for the Allied Paper, Inc./Portage Creek Kalamazoo River Superfund Site Project in Allegan County, Michigan. December 30, 2016.

ESI, Inc. 2017. Freshwater Mussel (Unionidae) Relocations in the Kalamazoo River for the Allied Paper, Inc./Portage Creek Kalamazoo River Superfund Site Project in Allegan County, Michigan. February 14, 2017.

ESI, Inc. 2018. Freshwater Mussel (Unionidae) Relocations in the Kalamazoo River for the Allied Paper, Inc./Portage Creek Kalamazoo River Superfund Site Project in Allegan County, Michigan. March 8, 2018.

MDNR and GEI, 2020. March 10, 2020 in-person meeting at Constitution Hall MDNR office, 525 Allegan Street, Lansing, Michigan, to discuss Kalamazoo River Area 4 TCRA Mussel Work Plan. Attendees included Scott Hanshue, Kesiree Thiamkeelakul, and Mark Mills (MDNR); and Stu Kogge, Ryan Holem, and Kelly Rice (GEI).

MDNR, MDEQ, MNFI, USFWS, MDOT, 2019. Michigan Freshwater Mussel Survey Protocols and Relocation Procedures. May 2019, Version 2.

Mulcrone and Mehne, 2001. Freshwater mussels of the Kalamazoo River, Michigan, from Battle Creek to Saugatuck.

MNFI, 2011. Mussel Shell Survey Report: Kalamazoo River Unionid Mussel Shell Survey in the Marshall and Battle Creek Area. October 2010.

Occupational Safety and Health Administration (OSHA). Occupational Safety and Health Standards for Scuba Diving. Standard Number: 1910.424

Strayer, D. L., and D. R. Smith, 2003. A guide to sampling freshwater mussel populations. American Fisheries Society Monograph 8. Bethesda, Maryland.

USFWS, 2020. February 24, 2020 phone conversation with Jessica Pruden (USFWS), Ryan Holem and Stu Kogge (GEI).

Woolnough, D., (Unpublished). Freshwater Mussel Occurrence Data in the Kalamazoo River. Conducted in conjunction with Central Michigan University.

Figures

Area 4 Boundary
Subarea A
Subarea B
Subarea C
Subarea D
Subarea E
Subarea F
Subarea G
Subarea H

*Sites are approximated and will be sized in accordance with number of mussels found.

0 600 1,200
SCALE, FEET

OU5 Allied Paper/Portage Creek/Kalamazoo River Superfund Site
Area 4 TCRA - Allegan County, Michigan

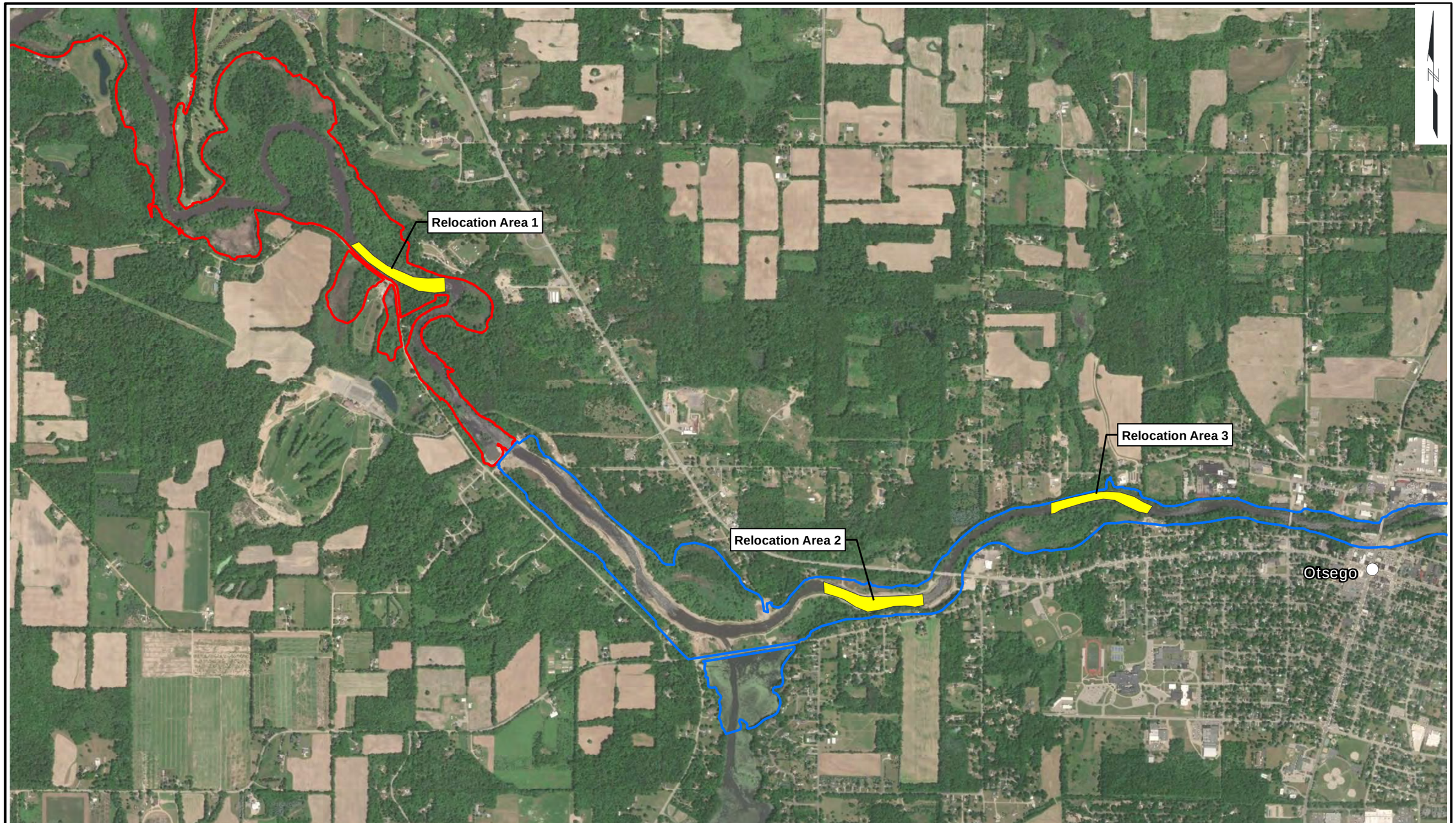
Kalamazoo River Areas 2, 3, and 4 Remediation LLC

Kalamazoo river cleanup group
AREAS 2, 3 AND 4 TCRA

AREA 4 TCRA
LOCATION MAP

Project 2000273 | March 2020 | Fig. 1

\\Sac1s-fs01\GIS\Projects\2000273_Kalamazoo_River_Cleanup_Program\GIS\A4_TCRA_WP\200330_A4_Mussel_Location.mxd



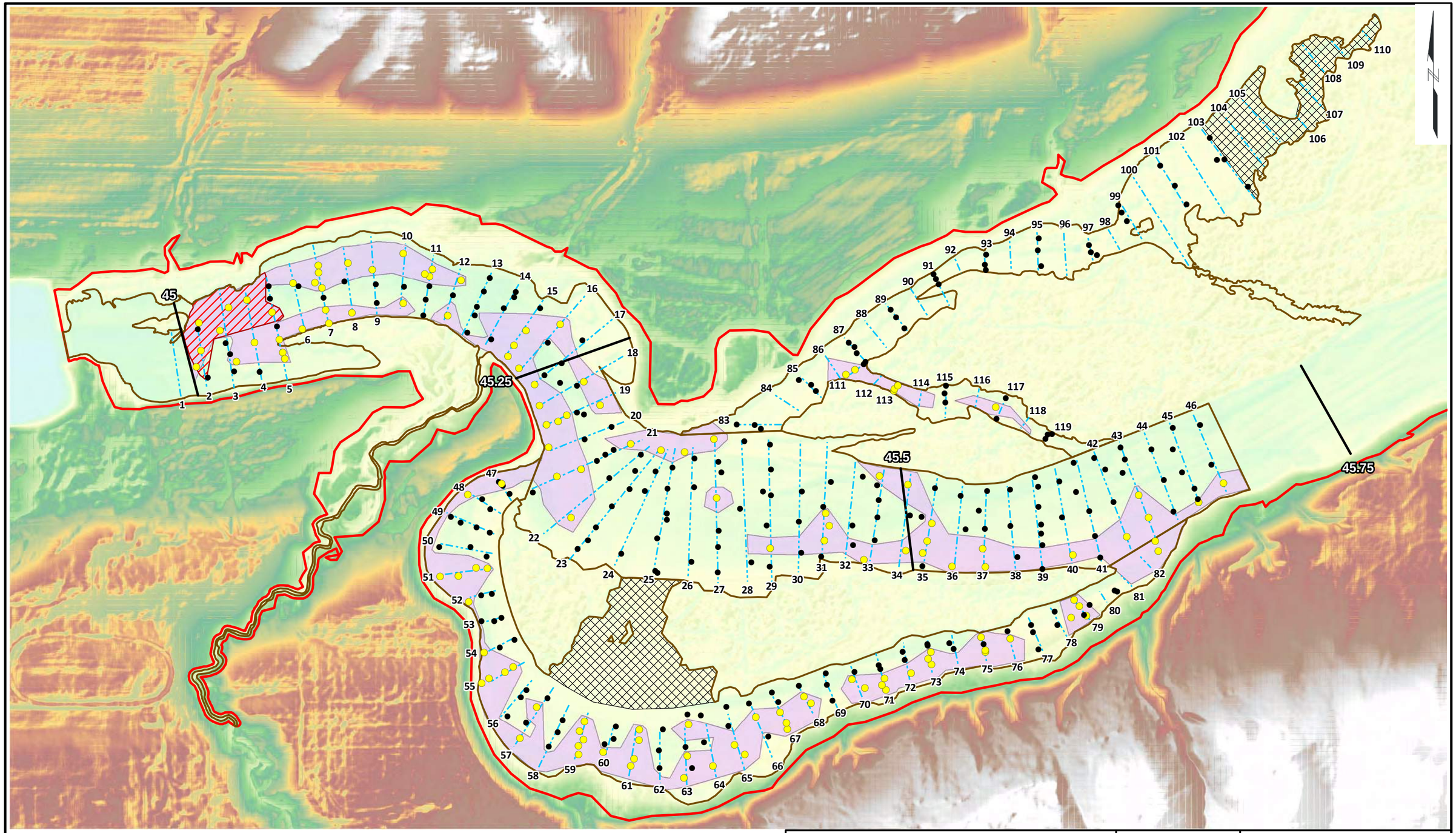
Potential Mussel Relocation Site
Area 3 Boundary
Area 4 Boundary

*Sites are approximated and will be sized in accordance with number of mussels found.

0 750 1,500
SCALE, FEET

OU5 Allied Paper/Portage Creek/Kalamazoo River Superfund Site Area 4 TCRA - Allegan County, Michigan	Kalamazoo river cleanup group AREAS 2, 3 AND 4 TCRA	POTENTIAL RELOCATION SITES FOR AREA 4 TCRA MUSSELS
Kalamazoo River Areas 2, 3, and 4 Remediation LLC	Project 2000273	March 2020 Fig. 2

\\Sac1s-fs01\GIS\Projects\2000273_Kalamazoo_River_Cleanup_Program\GIS\A4_Mussels\200527_A4_Mussel_Relocation.mxd



Suitable Mussel Habitat
Unsuitable Mussel Habitat
Mussel Recon Transect (25 m)
1/4 River Mile Marker Lines
Area 4 Boundary
Area 4 Subarea Boundary
Wetland/Emergent Vegetation
No Salvage (Unsafe Current Velocities)
Potential Mussel Habitat

0 140 280
SCALE, FEET

OU5 Allied Paper/Portage Creek/Kalamazoo River Superfund Site
Area 4 TCRA - Allegan County, Michigan

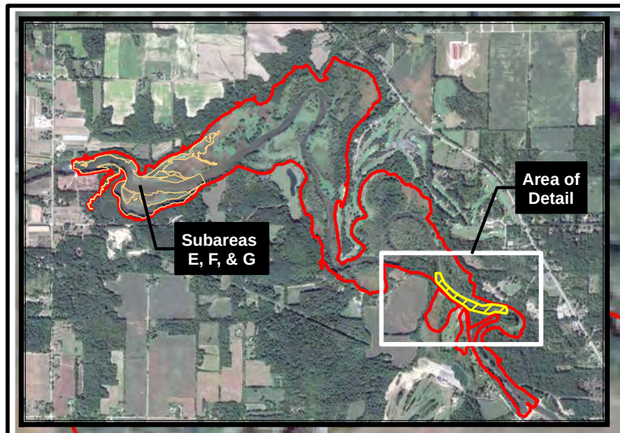
Kalamazoo River Areas 2, 3, and 4 Remediation LLC

Kalamazoo river cleanup group
AREAS 2, 3 AND 4 TCRA

SUBAREAS E, F, AND G
POTENTIAL MUSSEL HABITAT

Project 2000273 | May 2020 | Fig. 3

\\Sac1s-fs01\GIS\Projects\2000273_Kalamazoo_River_Cleanup_Program\GIS\A4_Mussels\200527_A4_MusselHabitat.mxd



48.5

48.75

49

N

1/4 River Mile Marker Lines
Mussel Relocation Area 1
Suitable Relocation Habitat
Area 4 Subarea Boundary
Area 4 Boundary

0 140 280
SCALE, FEET

OU5 Allied Paper/Portage Creek/Kalamazoo River Superfund Site
Area 4 TCRA - Allegan County, Michigan

Kalamazoo River Areas 2, 3, and 4 Remediation LLC

MUSSEL RELOCATION AREA 1

Project 2000273 | May 2020 | Fig. 4

\\Sac1s-fs01\GIS\Projects\2000273_Kalamazoo_River_Cleanup_Program\GIS\A4_Mussels\200527_A4_Relocation_Area1.mxd

Appendix A – Substrate/Mussel Reconnaissance Effort Representative Photographs

Photograph 1: Subarea E Transect 3 right descending bank - gravel cobble substrate

Photograph 2: Subarea E Transect 5 right descending bank - gravel cobble substrate

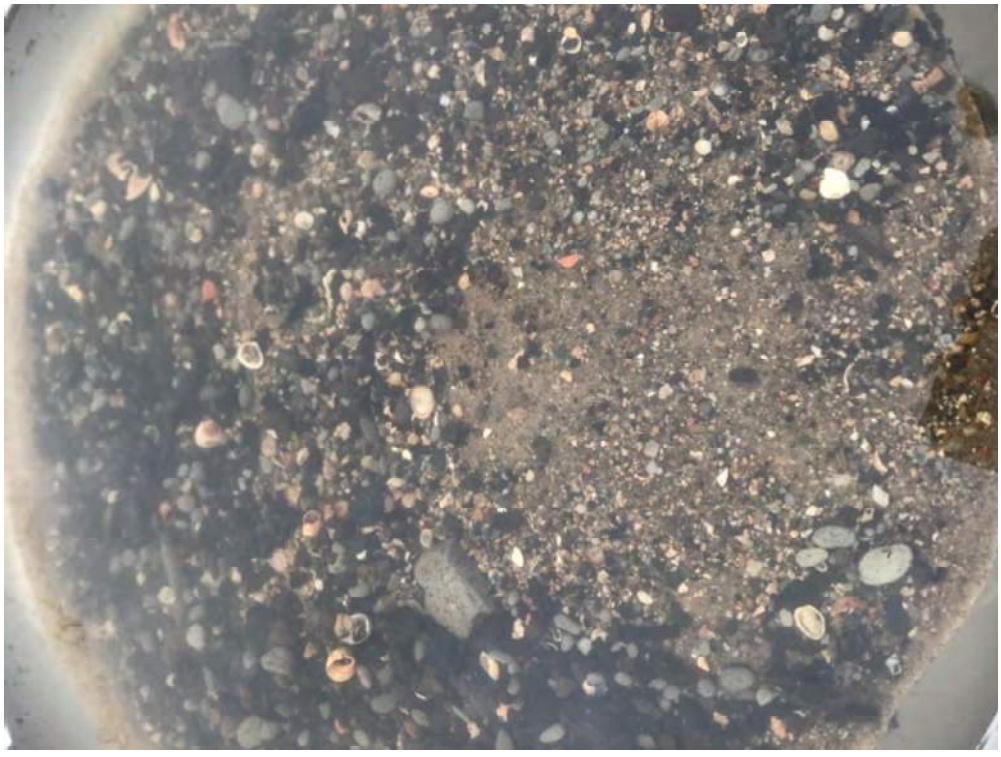
Photograph 3: Subarea E Transect 6 mid-channel - sand gravel substrate

Photograph 4: Subarea E Transect 7 right descending bank - compacted sand substrate

Photograph 5: Subarea E Transect 8 mid-channel - mobile sand gravel substrate

Photograph 6: Subarea E Transect 9 right descending near mid-channel - sand gravel clay substrate

Photograph 7: Subarea E Transect 11 mid-channel - mobile sand substrate



Photograph 8: Subarea E Transect 12 mid-channel - mobile sand gravel substrate

Photograph 9: Subarea E Transect 13 mid-channel - mobile sand detritus substrate

Photograph 10: Subarea E Transect 15 mid-channel - gravel cobble substrate

Photograph 11: Subarea E Transect 16 mid-channel - mobile sand substrate

Photograph 12: Subarea E Transect 18 mid-channel - mobile sand substrate

Photograph 13: Subarea E Transect 18 right descending bank - sand silt detritus substrate

Photograph 14: Subarea E Transect 19 right descending bank - sand silt substrate

Photograph 15: Subarea E Transect 20 mid-channel - mobile sand substrate

Photograph 16: Subarea E Transect 22 mid-channel - mobile sand substrate

Photograph 17: Subarea E Transect 23 right descending near mid-channel - mobile sand substrate

Photograph 18: Subarea E Transect 24 mid-channel - mobile sand substrate

Photograph 19: Subarea E Transect 26 mid-channel - mobile sand substrate

Photograph 20: Subarea E Transect 28 mid-channel - mobile sand substrate

Photograph 21: Subarea E Transect 30 mid-channel - mobile sand substrate

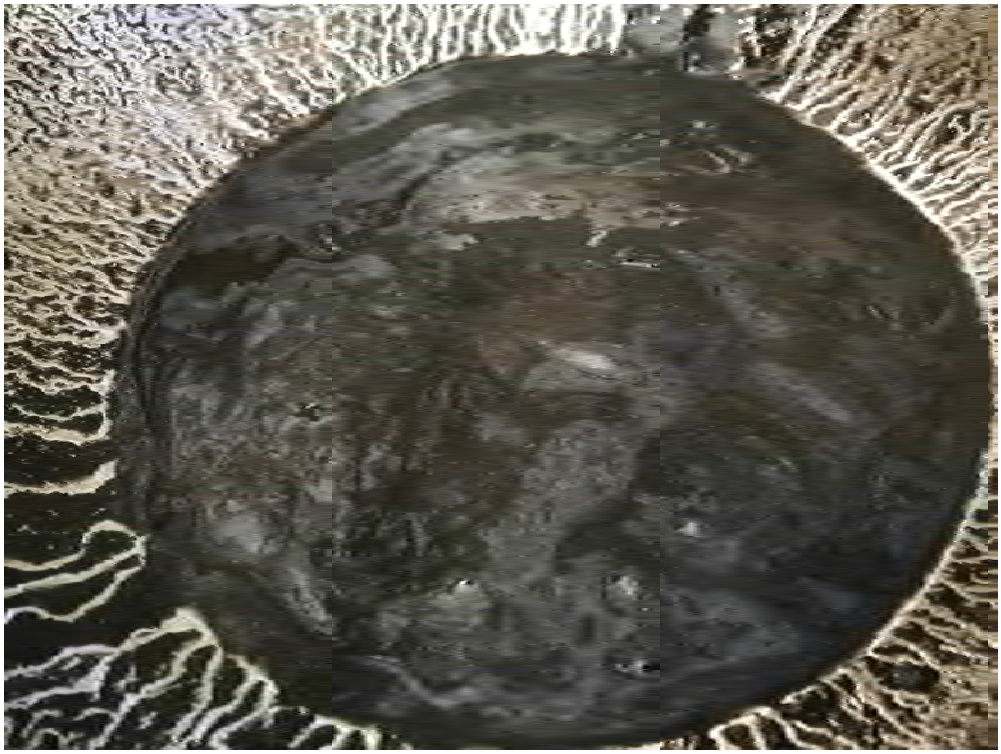
Photograph 22: Subarea E Transect 32 left descending bank - mobile sand substrate

Photograph 23: Subarea E Transect 34 mid-channel - mobile sand substrate

Photograph24: Subarea E Transect 36 mid-channel - mobile sand substrate

Photograph 25: Subarea F Transect 63 left descending bank

Photograph 26: Subarea F Ponar grab sample



Photograph 27: Subarea F Transect 47 left descending bank - silt gravel substrate

Photograph 28: Subarea F Transect 47 left descending bank - silt gravel substrate

Photograph 29: Subarea F Transect 51 left descending bank - silt sand substrate

Photograph 30: Subarea F Transect 51 left descending bank - silt muck substrate

Photograph 31: Subarea G Transect 87 right descending bank - dense submergent and emergent aquatic vegetation

Photograph 32: Subarea G Transect 97 right descending bank - dense submergent and emergent aquatic vegetation

Photograph 33: Subarea G Transect 99 right descending bank - dense submergent and emergent aquatic vegetation

Photograph 34: Subarea G Transect 104 mid-channel - dense submergent and emergent aquatic vegetation

Photograph 35: Subarea G Transect 83 left mid-channel - silt muck substrate

Photograph 36: Subarea G Transect 95 left descending bank - silt muck detritus substrate

Photograph 37: Subarea G Transect 117 left mid-channel - silt sand clay substrate

Photograph 38: Subarea G Transect 95 left descending bank - silt sand clay substrate with submergent aquatic vegetation

Photograph 39: Relocation Area 1 upstream extent facing downstream

Photograph 40: Relocation Area 1 upstream extent facing upstream

Photograph 41: Relocation Area 1 right descending bank near downstream extent—substrate poling

Photograph 42: Relocation Area 1 right descending bank near downstream extent facing upstream

Appendix B – GEI Permits

Michigan Department of Natural Resources – Fisheries Division

SCIENTIFIC COLLECTOR'S PERMIT

Issued under the authority of Public Act 451 of 1994, Part 487, as amended, section 324.48735.

Under the provisions of Part 487, Act 451, P.A. 1994, as amended, being section 324.48735, permission is hereby granted to:

Title	First Name Ryan	Last Name Holem
Co-Permittee Stuart Kogge	Co-Permittee Daniel Kowalski	Co-Permittee
Institution/Affiliation GEI Consultants of Michigan, P.C.		
Mailing Address 3832 Baulistrol Dr, Okemos, Michigan, 48864		

To survey, handle, take, catch, kill and/or possess species from the waters and land within the jurisdiction of this state, as specified below in the special provisions section. This permit limits the take of the species authorized to the **minimum** number needed.

Prior to field activities occurring on any stream, public lake or public lands under this permit, the permittee **must notify** the local fish biologist or Fisheries Division supervisor of the Management Unit where collections will occur. This contact must be made at least 48 hours prior to commencing field work and during normal business hours Monday-Friday between 8 a.m. and 5 p.m. If a set work schedule has been established for the field season, providing a copy to the unit may alleviate the need for additional contacts with a single unit. It is also strongly recommended that the permittee notify the District Law Supervisor for the county where the permit is being used. Failure to notify the law supervisor may result in the disruption of field work. Both contacts can be initiated by calling the appropriate operational service center (map and phone numbers provided separately).

SPECIAL PROVISIONS:

Project #1 – Boardman River mussel relocation, Gurnsey Lake Rd. (Grand Traverse Co): Site is southwest of Kalkaska, MI (GPS Lat 44.701374°, Long -85.344475°). A sediment trap on the Boardman River is being cleaned out at this site. Permittees are authorized to relocate freshwater mussels to an MDNR-approved relocation site. A semi-quantitative survey will be conducted in the proposed relocation area only. T/E mussels would be marked or tagged if follow-up monitoring is required. Methods will follow protocol specified in the document titled "Michigan Freshwater Mussel Survey Protocols and Relocation Procedures" (2019, v2).

Project #2 - AuSable River mussel monitoring, M-33 bridge (Oscoda Co): Site is near Mio, MI (GPS Lat 44.659731, Long -84.129082). State-listed mussels were relocated at this site in advance of bridge repairs in 2020 and are to be monitored in 2021. Permittees are authorized for general survey purposes to collect, identify, enumerate and release freshwater mussels. Monitoring methods will follow protocol specified in the document titled "Michigan Freshwater Mussel Survey Protocols and Relocation Procedures" (2019, v2).

Project #3 Grand Mere Lake Outlet (aka Wall Drain) qualitative mussel survey (Berrien Co): Site is an outlet to Lake Michigan, just west of Stevensville, MI (Lat 42.016692°, Long -86.544543°). This outlet is being dredged for connectivity to Lake Michigan. Permittees are authorized to collect, identify, enumerate and release freshwater mussels as part of visual and qualitative survey efforts. If live (native) mussels are found, they may be relocated to an MDNR-approved relocation site. T/E mussels would be marked or tagged if follow-up monitoring is required. Handling and processing of any mussels found will be consistent with guidelines specified in the document titled "Michigan Freshwater Mussel Survey Protocols and Relocation Procedures" (2019, v2).

Project #4 – Little River mussel surveys, N-3 bridge (Menominee Co): Site is south of Wallace, MI (GPS Lat 45.271970°, Long -87.604405°). Bridge rehabilitation is being conducted at this road crossing and semi-quantitative mussel survey efforts are required in advance of bridge work. The permittees are authorized to collect, identify, enumerate and release freshwater mussels. Relocation of mussels to an MDNR-approved relocation site is authorized pending results of semi-quantitative survey. T/E mussels would be marked or tagged if follow-up monitoring is required. Methods will follow protocol specified in the document titled "Michigan Freshwater Mussel Survey Protocols and Relocation Procedures" (2019, v2).

Project #5 – Shakey River mussel relocation, CR-577 crossing (Menominee Co): Site is north of Banat, MI (GPS Lat 45.547211°, Long -87.705092°). The culvert at this road crossing is being replaced and mussel relocation efforts will take place prior to culvert replacement. Permittees are authorized to collect, identify, enumerate and release freshwater mussels. Mussels may be relocated to an MDNR-approved relocation site. A semi-quantitative survey will be conducted in the proposed relocation area only. T/E mussels would be marked or tagged if follow-up monitoring is required. Methods will follow protocol specified in the document titled "Michigan Freshwater Mussel Survey Protocols and Relocation Procedures" (2019, v2).

Project #6 – Dunn Paper Menominee River mussel relocation (Menominee Co): Site is near mouth of Menominee River, MI (GPS Lat 45.095713°, Long -87.593835°). Rip-rap is being placed near the shoreline at this site to improve shoreline stability and provide erosion protection. Permittee are authorized to collect, identify, enumerate and release freshwater mussels. Mussels may be relocated to an MDNR-approved relocation site. A semi-quantitative survey will be conducted in the proposed relocation area only. T/E mussels would be marked or tagged if follow-up monitoring is required. Methods will follow protocol specified in the document titled "Michigan Freshwater Mussel Survey Protocols and Relocation Procedures" (2019, v2).

Project #7 – MDOT mussel relocations – Kalamazoo River and Grand River (Allegan and Eaton Counties): Kalamazoo River site is near Saugatuck, MI (GPS Lat 42.645900°, Long -86.187800°); Grand River site is southwest of Lansing, MI (GPS Lat 42.670100°, Long -84.645200°). Bridge rehabilitation and/or repair work is slated for both of these locations, requiring mussel relocation in advance of the bridge work. Permittees are authorized to collect, identify, enumerate and release freshwater mussels. Mussels will be relocated to an MDNR-approved relocation site specific to each water course. A semi-quantitative survey will be conducted in the proposed relocation area only. T/E mussels would be marked or tagged if follow-up monitoring is required. Methods will follow protocol specified in the document titled "Michigan Freshwater Mussel Survey Protocols and Relocation Procedures" (2019, v2). GEI has not been awarded this project – award decision is expected June 2021.

Project #8 – NCR Kalamazoo River mussel salvage and qualitative mussel surveys (Allegan Co): Permittees are authorized to collect, identify, enumerate and release freshwater mussels. This is a mussel salvage effort being conducted in advance of sediment dredging efforts to clean up contaminated sediments in the Kalamazoo River. Mussels will be salvaged from Area 4 (OU5), Subarea E of the Kalamazoo River and relocated upstream to a relocation area approved by MDNR in 2020. Subarea E mussel salvage areas and the upstream relocation area are documented in the work plan titled "Mussel Work Plan - OU5 Area 4 Time-Critical Removal Action - Allied Paper/Portage Creek/ Kalamazoo River Superfund Site", which was approved by USEPA on April 13, 2020, and in the report titled “210108_GEI_A4TCRA_2020 Mussel Salvage Report”. T/E mussels would be marked or tagged if follow-up monitoring is required. Qualitative (reconnaissance) and semi-quantitative mussel surveys in Kalamazoo River Area 4 (OU5), Subareas C & D may also be conducted. Subarea C & D mussels will be returned to the location in which they were found, and

mussel survey methods will follow protocol specified in the document titled "Michigan Freshwater Mussel Survey Protocols and Relocation Procedures" (2019, v2). Questions about the mussel survey protocols on the Kalamazoo River should be directed to DNR Fisheries Local Biologist, Matt Diana (dianam@michigan.gov).

Project #9 – Quantitative or semi-quantitative mussel surveys – multiple locations Grand River (Kent Co): Sites are in downtown Grand Rapids, MI. Riverside construction (e.g., boardwalk/pedestrian walkway installation) may take place at these locations, requiring site-specific knowledge of the mussel community in front of each site. Permittees are authorized to collect, identify, enumerate and release freshwater mussels. Quantitative or semi-quantitative mussel surveys will be conducted along the left downstream bank at three locations on the Grand River: 1) Ann Street crossing (GPS Lat 42.995435°, Long -85.671963°), 2) railroad bridge crossing south of Ann Street (GPS Lat 42.992307°, Long -85.672303°), and 3) Leonard Street crossing (GPS Lat 42.984665°, Long -85.671787°). Survey areas are approximately 225 feet long (upstream and downstream) by 50 feet wide (from left descending bank). T/E mussels would be marked or tagged if follow-up monitoring is required. Mussels will be returned to the location in which they were found and mussel survey methods will follow protocol specified in the document titled "Michigan Freshwater Mussel Survey Protocols and Relocation Procedures" (2019, v2).

Project #10 Ox Creek P51 Survey (Berrien Co): This is a repeat of the P51 procedures conducted previously on a 500 foot reach of Ox Creek for Marathon Petroleum and Pescador near Benton Harbor, MI (Lat 42.116806°, Long -86.448558°). Permittees are authorized to collect, identify, enumerate and release fish. Fish, macroinvertebrate, and habitat assessments will be conducted using methods consistent with Michigan SWAS Procedure 51 (P51) protocol (2008). All organisms will be released following collection and identification.

Project #11 Little Black Creek (aka Old Dutch Creek) P51 Survey (Muskegon Co): Site is near Muskegon, MI (adjacent to Lat N 43.2065°, W 86.18286°). Permittees are authorized to collect, identify enumerate and release fish. Fish, macroinvertebrate, and habitat assessments will be conducted using methods consistent with Michigan SWAS Procedure 51 (P51) protocol (2008). All organisms will be released following collection and identification.

Project #12 P51 Surveys – Elm Creek and AuGres River water courses (Iosco Co): Sites are near National City, MI. Approximate GPS coordinates for survey sites are as follows: 1) unnamed tributary to Elm Creek (GPS Lat 44.26188°, Long 83.76031°), 2) Elm Creek (GPS Lat 44.25033°, Long 83.7599°), 3) unnamed tributary to Elm Creek (GPS Lat 44.24356°, Long 83.7458°), 4) tributary to East Branch AuGres River (GPS Lat 44.26329°, Long 83.71696°), and 5) unnamed tributary to Elm Creek (GPS Lat 44.25166°, Long 83.74259°). Permittees are authorized to collect, identify, enumerate and release fish. Fish, macroinvertebrate, and habitat assessments will be conducted using methods consistent with Michigan SWAS Procedure 51 (P51) protocol (2008). All organisms will be released following collection and identification.

Project #13: MDOT Swan Creek mussel salvage/relocation, I-75 overpass (Monroe County): Site is near Newport, MI (GPS 42.0068, -83.3128). I-75 overpass rehabilitation is being conducted over the Swan Creek at this location. Permittees are authorized to collect, identify, enumerate and release freshwater mussels as part of a mussel salvage/relocation effort conducted under the overpass in accordance with the associated MDOT work order. Mussels will be relocated to an MDNR-approved relocation site outside of the project area. T/E mussels would be marked or tagged if follow-up monitoring is required. Methods will follow protocol specified in the document titled “Michigan Freshwater Mussel Survey Protocols and Relocation Procedures” (2021, v3).

Project #14: MDOT Grand River mussel relocation, I-196 overpass (Kent County): Site is near Grand Rapids, MI (GPS Lat 42.947554, Long 85.710629,). I-196 bridge/overpass rehabilitation is being conducted over the Grand River at this location. Permittees are authorized to collect, identify, enumerate and release freshwater mussels as part of a mussel salvage/relocation effort in accordance with the associated MDOT work order. Mussels will be relocated upstream to a relocation area already approved by MDOT, MDNR, and USFWS. T/E

b. A 20 min 100% vinegar bath can be substituted as a bleach alternative.

3) If using a boat, live wells and bilges must be emptied and disinfected with a solution of 1 cup of bleach to 10 gallons of water prior to moving between waterbodies.

a. A 20 min Virkon Aquatic bath can be substituted as a bleach alternative.
b. A 20 min 100% vinegar bath can be substituted as a bleach alternative.

For more information on VHS or invasive species, go to the Fisheries link on the Department of Natural Resources web site at: http://www.michigan.gov/dnr

Permitted collection area:
Project #1 Boardman River, Grand Traverse County, Lake Michigan Basin;
Project #2 AuSable River, Oscoda County, Lake Huron Basin;
Project #3 Grand Mere Lake Outlet, Berrien County, Lake Michigan Basin;.
Project #4 Little River, Menominee County, Lake Michigan Basin;
Project #5 Shakey River, Menominee County, Lake Michigan Basin;
Project #6 Menominee River, Menominee County, Lake Michigan Basin;
Project #7 Kalamazoo River Allegan County & Grand River Eaton County, Lake Michigan Basin;
Project #8 Kalamazoo River, Allegan County, Lake Michigan Basin;
Project #9 Grand River, Kent County, Lake Michigan Basin;
Project #10 Ox Creek, Berrien County, Lake Michigan Basin;
Project #11 Little Black Creek, Muskegon County, Lake Michigan Basin;
Project #12 Elm Creek and AuGres River in Iosco County, Lake Huron Basin;
Project #13 Swan Creek in Monroe County (I-75 overpass), Lake Erie Basin;
Project #14 Grand River in Kent County (I-196 overpass), Lake Michigan Basin;
Project #15 Roselawn Creek and Bond Falls impoundment and outflow near Paulding Michigan in Ontonagon County, Lake Superior Basin;
Project #16 Flint River in the vicinity of the M57 bridge crossing in Genesee County, Lake Huron Basin; and
Project #17 Kalamazoo River in the vicinity of the North Albion Street crossing in Calhoun County, Lake Michigan Basin.

Permitted collection gear:
Mussel Surveys – All mussel surveys and relocation efforts authorized above are to be conducted by hand with the aid of mesh bags to carry mussels when necessary.

Fish Surveys – All fish surveys authorized above are to be conducted by electrofishing with hand/dip nets or other methods approved in writing by the local DNR fisheries office.

Completion of an annual report is required with this permit. It shall be provided to DNR, Fisheries Division using online Collector's Report Form at www.michigan.gov/scientificcollectorspermit.

GENERAL PROVISIONS: This permit must be in permittee's possession during collection in the field or the location where specimens are being held and must be made available upon request of any Department representative. Activities under this permit are limited to species not listed as threatened or endangered unless the permittee(s) is also in possession of the required Threatened and Endangered Species Permit from DNR Wildlife Division for state listed species as well as the proper permit(s) from the US Fish and Wildlife Service for federally listed species. This permit is not transferable. This permit does not provide any authorization to circumvent any federal, state, or local laws and ordinances, including, but not limited to restricted entrance to refuges or other areas closed to the public without written permission of the land administrator.

In addition to this permit, separate DNR Public Land Use permits are required from:

1) Parks and Recreation Division for activities in State Parks and Recreation Areas and at the state boat launches;
2) Wildlife Division for activities in State Game Areas; and
3) Forest Resources Division for activities in State Forests

Public Land Use Permit applications can be obtained online at:
https://www.michigan.gov/dnr/0,4570,7-350-79136_79262_80436_85611---,00.html

Permittees are also advised to contact the US Forest Service and/or National Park Service about any permit requirements for activities occurring in Michigan's National Forests and National Parks, respectively.

All sampling gear that is deployed and left unattended in the field by persons permitted under this program must be clearly labeled with the name of the permittee's affiliation (university, zoo, consulting firm, agency, etc.) on the sampling gear itself or on at least one of the buoys or floats used to mark deployed gear that is submerged. Additionally, boats used to conduct permit activities must also be clearly marked on the sides of the vessel with the permittee's affiliation.

Any violation of the conditions of this permit may result in revocation of this permit and misdemeanor penalties of imprisonment for not more than 90 days or a fine of not more than $500 or all of the above.

FOR DNR USE ONLY		
Permit Number FSCP05192021143524	Issue Date 05/21/2021	Expiration Date 12/31/2021
cc: NLMMU, CLMMU, SLMMU, NLHMU, SLHMU, LEMU, Threatened & Endangered		
For, James L. Dexter, Chief, MDNR Fisheries Division		

STATE OF MICHIGAN
DEPARTMENT OF NATURAL RESOURCES
LANSING

GRETCHEN WHITMER
GOVERNOR

DANIEL EICHINGER
DIRECTOR

May 6, 2021

Ryan R. Holem
GEI Consultants of Michigan. P.C.
230 N. Washington Square, Suite 201
Lansing, MI 48933

Dear Ryan Holem,

This letter is an official attachment to your Threatened and Endangered Species Permit **(TE 029).** Your permit is issued in the *Consultant* category only. Your permit expires on **March 31, 2022**. Renewal information will be sent in December of 2021.

Authorization:
To conduct the scientific activities listed under special conditions on the threatened/endangered species listed below. All activities are subject to the standard permit conditions within this letter.

In addition to the standard requirements listed on the back of this permit:

- This permit provides legal authorization to work with the listed threatened and endangered species, as well as the unintentional and incidental take of those species if done in accordance with this permit.
- This permit does not allow for take or translocation of species to facilitate the completion of a project.
- Additional permits may be required on specific projects that may affect threatened and endangered species. Such permits are negotiated by the Department of Natural Resources and issued to the client or landowner. Additional federal permits may be required for federally listed species.
- Permitted are surveys for listed plant and animal species using standard methods and appropriate timing to ensure a high probability of detecting the presence of the species. Only survey methods that minimize disturbance and risk to the organism or its habitat are to be used. Specific requirements for certain taxa are listed below.
- Subpermittees: are those working under the direction of the permitee.

Plants

- Permitted is the survey of threatened plants for identification and documentation, for environmental impact analysis, and to provide new information on the distribution of listed plant species. Endangered species are not authorized for collection. Use photography or non-destructive collection techniques for documentation whenever feasible (and by limiting

collections to leaves, flowers, or fruits). Surveys must be done in a manner that will not cause harm to the population or its habitat.

Mollusks

- Permitted is the collection and temporary holding of mussels for identification. Sampling must be done in a manner that minimizes the amount of time taken from the water and risk to the animals. Animals handled must be returned to the same site where collected, or to a relocation area that has been approved by MDNR.

Insects

- Handling of threatened and endangered insects is permitted when needed for identification and documentation. Surveys must not significantly reduce the size of the local population and must be done in a manner that will not cause harm to the population or its habitat. Use non-lethal survey and capture techniques such as carful capture and release or photography whenever possible.

Fish

- Listed fish species may be humanely captured for identification and released at the same site using standard non-lethal collection techniques. Dead specimens may be salvaged.

Birds

- Capture or collection of listed birds is not permitted. Use non-lethal techniques such as photography or recordings of songs when specific documentation is required.

Reptiles and Amphibians

- Threatened and endangered reptiles and amphibians may be humanely captured for identification and examination and released at the same site.

Mammals

- Rely on the use of sign or other observations to determine the presence of mammals to the extent possible. Small mammals (e.g., bats, shrews, and voles) may be live trapped when needed to determine their presence but must be released on site unharmed. Larger mammals may not be captured.

Standard Permit Conditions

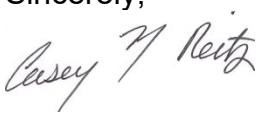
A. All specimens authorized for collection under this Permit shall be deposited in the collection of an approved public educational or research institution prior to Permit expiration.
B. None of the specimens collected shall become part of a private collection or private property.
C. This permit does not allow or grant the right of trespass. Projects shall not take place on any private or public lands without permission from the owner or administrator of such lands.
D. This permit does not provide authorization to circumvent any federal, state, or local laws and ordinances.

E. Additionally, federal permits may be required for activities affecting federally listed threatened or endangered species and/or migratory birds. Contact the U. S. Fish and Wildlife Service at 2651 Coolidge Road, East Lansing, MI 48823.
F. The activities covered under this Permit are not transferable to another person unless specifically authorized.
G. Unless otherwise noted, within 10 days of the expiration of this Permit, the holder is required to file a report detailing the locations of any threatened and endangered species encountered and the number and disposition of specimens handled. Annual reports for multi-year permits are due at the end of each calendar year.
H. A person conducting any activities authorized by this permit shall carry a copy of this permit and shall produce a copy of this permit upon request of a Department of Natural Resources employee or law enforcement officer.

All permits require and annual report unless indicated otherwise. You can use the enclosed report form and submit forms via email to reitzc@michigan.gov. In addition, please report any new occurrences of threatened and endangered species as soon as possible instead of waiting until the end of the year. This will allow new data to be incorporated into the Michigan Natural Features Inventory database sooner, thus ensuring greater protection for these species and their habitats.

Thank you for helping protect our threatened and endangered species. Feel free to contact me with any questions or concerns.

Sincerely,



Casey M. Reitz, Permit Specialist
DNR-Wildlife Division
Phone: 517-284-6210
Fax: 517-335-6604
reitzc@michigan.gov
www.michigan.gov/wildlifepermits

NATIVE ENDANGERED & THREATENED SP. RECOVERY
ENDANGERED & THREATENED WILDLIFE

Permit Number: TE33374D-0

Effective: 07/25/2019 Expires: 12/31/2024

Issuing Office:

Department of the Interior
U.S. FISH & WILDLIFE SERVICE
Endangered Species Permit Office
5600 American Boulevard, West, Suite 990
Bloomington, MN 55437-1458
permitsR3ES@fws.gov

For
Chief - Endangered Species

Permittee:

GEI CONSULTANTS OF MICHICAN, P.C.
PO BOX 6820
TRAVERSE CITY, MI 49686-6820
U.S.A.

Name and Title of Principal Officer:
STUART N KOGGE - VICE PRESIDENT/WETLAND-AQUATIC BIOLOGIST

Authority: Statutes and Regulations: 16 USC 1539(a), 16 USC 1533(d); 50 CFR 17.22, 50 CFR 17.32, 50 CFR 13.

Location where authorized activity may be conducted:
ON LANDS SPECIFIED WITHIN THE ATTACHED SPECIAL TERMS AND CONDITIONS

Reporting requirements:
ANNUAL REPORT DUE: 01/31
See permit conditions for reporting requirements

Authorizations and Conditions:

A. General conditions set out in Subpart B of 50 CFR 13, and specific conditions contained in Federal regulations cited above, are hereby made a part of this permit. All activities authorized herein must be carried out in accordance with and for the purposes described in the application submitted. Continued validity, or renewal of this permit is subject to complete and timely compliance with all applicable conditions, including the filing of all required information and reports.

B. The validity of this permit is also conditioned upon strict observance of all applicable foreign, state, local, tribal, or other federal law.

C. VALID FOR USE BY Stuart Kogge and Ryan Holem. Trained assistants not named on this permit may conduct activities pursuant to this permit only under the direct, on-site supervision of an independently authorized individual listed above. "On-site" supervision means having the authorized individual at a distance that would allow this individual to assist immediately a supervised individual, as needed, while they are conducting an authorized activity.

D. ACCEPTANCE OF THIS PERMIT SERVES AS EVIDENCE THAT THE PERMITTEE AND ITS AUTHORIZED AGENTS UNDERSTAND AND AGREE TO ABIDE BY THE TERMS OF THIS PERMIT

AND ALL SECTIONS OF TITLE 50 CODE OF FEDERAL REGULATIONS, PARTS 13 AND 17, PERTINENT TO ISSUED PERMITS. SECTION 11 OF THE ENDANGERED SPECIES ACT OF 1973, AS AMENDED, PROVIDES FOR CIVIL AND CRIMINAL PENALTIES FOR FAILURE TO COMPLY WITH PERMIT CONDITIONS.

E. Permittee is authorized to take (capture, handle, and release) by hand via wading, snorkeling, or diving for scientific research (presence/absence surveys, studies to document habitat use, population monitoring, relocation to enhance the survival of the species (in limited areas, see condition I), and evaluation of potential impacts) aimed at recovery of the following species:

Clubshell (*Pleurobema clava*)
Northern riffleshell (*Epioblasma torulosa rangiana*)
Rayed bean (*Villosa fabalis*)
Snuffbox (*Epioblasma triquetra*)

F. Activities are authorized at the following locations:

F.1. Locations within Region 3 of the USFWS: Michigan, upon receipt of written concurrence from the Field Supervisor, as outlined in Condition G.

G. Permittee shall notify and request approval from the USFWS Field Supervisor for the state in which activities are proposed to occur at least 15 days prior to conducting any activities. Contact information is available at: https://www.fws.gov/midwest/endangered/permits/. Your request for this site-specific approval must be in writing and must indicate:

G.1. Species for which activities are proposed.

G.2. Location of proposed activities, including project site, county, and state.

G.3. A full description of activities (i.e., proposed project plan, including purpose and need, surveys, methods, etc.)

G.4. Dates when the project is proposed to take place.

G.5. Evidence that Permittee has received any required contracts to complete the activities.

G.6 Whether all annual reporting requirements have been fulfilled.

G.7. You may proceed with activities only upon receipt of written concurrence from the applicable USFWS Field Supervisor. *Your concurrence letter must be carried with this permit to authorize site-specific activities.*

H. Permittee shall adhere to the following conditions regarding the capture and handling of mussels:

H.1. Permittee may take (remove from the substrate, by hand, for identification and data collection) mussels via wading, snorkeling, or diving and temporarily hold healthy specimens.

H.2. Permittee may temporarily hold specimens in mesh bags, either suspended in the water or held in a container containing river water, while awaiting identification and data collection. Specimens may be held for up to three hours if they are held in the water in bags that allow free movement of water in the river from which the mussels were taken or held in containers of water that is changed every hour [every half-hour when air temperatures are at or above 80° Fahrenheit (F)] and replaced with water freshly taken from the water where the mussels were collected. When practicable, specimens held in containers must remain in the shade. Specimens must be returned to the locality from which they were taken. Live specimens that cannot be identified at the site must be photographed for identification purposes.

H.3. Collection of live mussel specimens must be done only when the air temperature is above 32° F and the water temperature is above 40° F. No collection activities may be conducted when air temperature is above 90° F. Specimens shall be returned to the substrate as follows:

H.3.a. For surveys at water temperatures at or above 50° F, mussels may be dropped back into the water after identification.

H.3.b. For surveys conducted at water temperatures between 40° and 50° F, mussels must be returned to the substrate, by divers if necessary. Divers must return the specimen to the substrate by hand, placing them on their side and allowing them to burrow on their own. Where the substrate is very compacted cobble, a hole just large enough to receive the animal to a depth of 3/4 its length should be excavated and the mussel placed into it with the siphon (posterior) end up and pointing upstream.

H.4. All live mussels shall be measured (length and height) and, if possible, sexed and aged. No intrusive activities are permitted. Data collected shall include descriptions of external morphometry and reproductive status. All specimens of federally listed species - or a representative sample for each species - must be photographed prior to release.

H.5. Studies and surveys to monitor mussel communities shall be conducted by the permittee or persons named under condition C., above, or by individuals who are under the direct, and on-sight supervision of the permittee or named individuals.

I. Permittee shall adhere to the following conditions regarding the tagging of mussels:

I.1. Prior to any tagging activities the permittee shall meet with the USFWS Field Supervisor for the state(s) in which the activity is proposed. The USFWS Field Supervisor for the state(s) in which the activity is proposed, will specify in writing the nature of marking (e.g., shellfish tag vs. etching) to be used. This USFWS field office may convey this in any site-specific authorization provided or in writing separately.

J. The shells of all live specimens collected or captured temporarily must be thoroughly inspected for the presence of zebra mussels (*Dreissena polymorpha*). Unionids with zebra mussels attached must be cleaned by scrubbing prior to returning to the substrate. Document the incidence of zebra mussels and Asiatic clams (*Corbicula fluminea*) at project sites.

K. No live specimens may be removed from the survey sites, except for specimens encountered in circumstances that would reasonably be expected to result in stranding due to low or receding water. Such specimens may be moved

into deeper water at the survey site; to a suitable location near the survey site; or, to an alternative location coordinated with and approved by the appropriate U.S. Fish and Wildlife Field office in Condition Q.

L. Any dead endangered or threatened mussel shells and any specimens accidentally killed or that are moribund or freshly-dead and contain soft tissue are to be preserved according to standard museum practices, properly identified and indexed (collection site, UTM coordinates, site conditions when collected, date collected, and permit authorizing collection). All dead specimens shall be sent to a public scientific or educational facility or museum in the state the individuals were collected along with a copy of the permit(s) under which they were collected. All specimens retained under this permit remain the property of the United States Government and must clearly be identified as such.

M. Permittee shall notify the U.S. Fish and Wildlife Service Field Supervisor(s) in writing of any newly discovered species locations (previously undocumented sites only) within 48 hours of discovery unless otherwise specified by the Field Supervisor(s). Notification shall be provided in writing with a copy to the office identified in Condition Q. No voucher specimens may be collected. Any newly identified mussel sites shall be vouchered with photographs and/or video recordings.

N. Injuries and/or mortalities of listed species may not exceed two (2) specimens of a permitted species. In the event this number is met, all permitted activities must cease. You must contact the USFWS within one business day and explain the incident and its circumstances. Your initial contact may be made by telephone, however, a written explanation must be provided within five (5) days of the incident. You must contact the following USFWS offices: Regional Recovery Permits Coordinator, Bloomington, Minnesota (contact information in Condition P.1) and the Field Office for the state in which the activity occurred (contact information in Condition Q.). Following mortality or injury of two specimens of a permitted species, you may not resume activities authorized by this permit without written permission of the U.S. Fish and Wildlife Service, Regional office in Bloomington, Minnesota (Condition P.1.).

O. Reports are due on January 31 following each year this permit is in effect. In addition, copies of all reports and publications resulting from data obtained under the authority of this permit must be submitted as they become available. Failure to furnish any reports that are required by this permit is cause for permit revocation and/or denial of future permit applications. At minimum, your report shall include:

O.1. A complete discussion of field procedures, data collection methods, results, and conclusions;

O.2. The date, time, and locations (state, county, locality, UTM coordinates or GIS data with projection information) where each listed and/or proposed species was encountered and the location it was returned. We would also appreciate receiving this information for all candidate species encountered.

O.3. The locations of the surveyed sites where no listed species were located.

O.4. A description of locations surveyed (including negative surveys where no listed species were found) including: date, time, geographic locations (state, county, and geographic coordinates (using latitude and longitude in decimal degrees), water depth, substrate composition, sedimentation, and any other relevant data.

O.5. The size, estimated age, sex and condition (if determinable) of any listed individuals encountered, and any

other data you may have collected for individual naiads, such as evidence of damage or injury, and observations of zebra mussel (*Dreissena polymorpha*) and/or Asiatic clam (*Corbicula fluminea*) infestation.

O.6. A complete description of injuries and/or mortalities to listed species while in your possession, the dates of occurrence, any circumstances surrounding the incidents, and a description of any steps taken to reduce the likelihood that such injuries and/or mortalities will occur in the future;

O.7. If applicable, any identification numbers or marks added to live specimens

O.8. If applicable, a list of any salvaged specimens, locations where salvaged, their disposition, and where they are being maintained

O.9. Copies of any separate reports and/or publications resulting from work conducted under the authority of this permit.

O.10. Photographs of the identifying characteristics for each individual federally-listed species captured are encouraged, but not required.

O.11. Copies of all site specific authorization letters required under Condition G.

If no activities occurred over the course of the year, indication of such shall be submitted as an annual report.

The U.S. Fish and Wildlife Service is creating a database to support reporting for listed freshwater mussel permit holders. In the event this database becomes available you may are encouraged to submit annual reports through the database. The reporting database will help standardize data collection and increase efficiency in reporting.

P. Copies of your reports shall be sent to the offices listed below. When possible, electronic copies shall be submitted in lieu of hard copies in MS Word, Portable Document Format, Rich Text Format, or other file format that is compatible with the receiving office.

P.1. Regional Recovery Permits Coordinator
U.S. Fish and Wildlife Service - Midwest Region (Region 3)
Ecological Services - Endangered Species
5600 American Blvd. W., Suite 990
Bloomington, Minnesota 55437-1458
(612/713-5343; fax 612/713-5292)
permitsR3ES@fws.gov

Q. Additionally, based on geographic area, reports and publications shall be submitted to the offices listed under Field Office Contact Information at: https://www.fws.gov/midwest/endangered/permits/.

cc: FWS, TE Coordinators: Michigan
DNR/DOC, TE Coordinators: Michigan

Michigan Department of Natural Resources

APPLICATION/PERMIT TO USE STATE LAND

This information is required under authority of Part 5 of Act 451 of 1994, as amended, MCL 324.501- 511 and the Rules for the Regulation of State Lands, R299.921 – R299.932.

DNR USE ONLY
Management Unit: SWR
Permit Number: ASGA-21-017

APPLICANT: Please read all attachments before completing application. Submit completed application to local DNR office where permit is being sought. Application must be submitted at least sixty (60) days prior to proposed use. Attach additional information as needed to fully describe proposed use activity. Checks or money orders should be made payable to *"State of Michigan."*

- For Application/Permit to Use State Land for an Event, use DNR PR1138.
- Initial application fee of fifty dollars ($50.00) must be submitted with application.

Name of Applicant/Organization	Name of Contact Person
GEI Consultants of Michigan, P.C.	Kelly Rice
Address	**Address**
3065 Akers Mill Road, Suite 235	5225 Edgewater Drive
City, State, ZIP	**City, State, ZIP**
Atlanta, GA 30339	Allendale, MI 49401
Telephone / **FAX** / **Federal ID Number**	**Telephone** / **FAX** / **e-mail address**
(616) 384-2714 / ( ) N/A /	(616)844-8338 / ( ) N/A / krice@geiconsultants.com

Proposed location on state land (name of trail or Department facility or legal property description, and attach map, subject to correction by Department):
Kalamazoo River corridor through OU5 Areas 3 and 4. Existing boat launches at Trowbridge Dam and near the former Otsego Township Dam may be utilized.

Length of Use ☐1-2 Days ☐3-7 Days ☐8-31 Days ☐Seasonal/Periodic ☒Annual ☐Other:

Date(s) of Proposed Use	No. of Participants/Users	No. of Recreational Units (Camping)
April - December 2020	up to 20	N/A

Will the use of state land require or include:

use of parking lot/campground/access site?	☒No ☐Yes	If Yes, explain:	
structures or equipment be placed on state land?	☐No ☒Yes	If Yes, explain:	small temp mussel processing stations along riverbanks
sound amplification equipment be used?	☒No ☐Yes	If Yes, explain:	
food, beverages or other items be sold?	☒No ☐Yes	If Yes, explain:	
alcohol be served or consumed?	☒No ☐Yes	If Yes, explain:	
use of utilities (water, electric, sewer) ?	☒No ☐Yes	If Yes, explain:	

Type of Use ☐Geocache ☐Guiding ☐Oil & Gas Development-Related Use ☐Road Construction ☐Seismic Survey ☒Watercraft ☐Other (specify)

Description of Proposed Type of Use (Attach additional information as needed to fully describe proposed use activity.)

Mussel habitat reconnaissance surveys and salvage/relocation will be completed throughout OU5 Areas 3 and 4 via boat and land access. See attached Mussel Work Plan, approved by EPA, for more details.

APPLICANT: ***Read all pages and attachments before certification and signature.***

APPLICANT CERTIFICATION

I certify that the information submitted herein, including all attachments, is accurate and complete and that I have read and understand and agree to abide by the requirements contained on all attachments, including liability insurance and performance bonding requirements. I have enclosed the required Application Fee. I understand that, if I have submitted a Review Fee that is not the correct amount, an additional fee must be paid prior to review of my application. I also understand that all remaining fees for the use of the State Land must be received by the Department within 14 days of notification of approval to the applicant or permissions may be considered void.

Kelly Rice — *Applicant/Authorized Representative - Print or Type*
Kelly N. Rice — *Signature*
April 15, 2020 — *Date*

FOR DNR USE ONLY

Management Unit	County	Performance Bond Type / Amount	Receipt No.	Other Charges	Receipt No.
SWR	Allegan	☐Surety ☐Cash $ —	—	$ —	—

Review Fee	Receipt No.	Application Fee	Receipt No.	Use Fee	Receipt No.	Timber Consideration Fee	Receipt No.
$ —	—	$ —	—	$ —	—	$ —	—

Insurance Aggregate Amount	Date Permit Issued	Date Permit Expires	Applicant / Permit Number
$ 10,000,000	01/01/2021	12/31/2021	ASGA-21-017

DONALD E. POPPE — Department Representative (please print)
(269) 673-2430 — Telephone (with area code)
poppedd@michigan.gov — E-mail Address
Donald E Poppe — Signature
4590 118th Ave. Allegan, MI 49010 — Address

☒ **ADDITIONAL REQUIREMENTS: As contained in the attached Exhibit(s).**

DISTRIBUTION: ORIGINAL – Land Administering Division(LAD), Lansing
COPY – Applicant/Permittee, LAD Mgt Unit, LAD District

CONDITIONS AND REQUIREMENTS

1. Permit shall be available for inspection when Permittee is operating on State-owned land.
2. Permission for use shall expire on the date indicated, unless sooner terminated.
3. Payment in the amount specified shall be made prior to use of land, or in installments as indicated.
4. Permittee shall maintain the area under Permit in a clean and orderly condition.
5. Requests for Permit renewals should be made to the Department thirty (30) days prior to the expiration date of this Permit. Such requests will be considered only when all stipulations in the original Permit have been complied with.
6. The rights accruing under this Permit shall not be assigned or transferred without the written permission of the Department Representative.
7. Permittee shall not commit, cause, or allow to be committed, any waste of, or injury to, said premises or any part thereof, nor use the same except for the purpose indicated.
8. Temporary improvements may only be made if further authorized under the conditions of this Permit, or by separate written permission of the Department Representative.
9. Improvements made by the Permittee on said premises and not removed within 30 days after cancellation or expiration of this Permit, and when such removal shall be requested by the Department, AT THE DEPARTMENT'S OPTION, shall become attached and remain a part of the premises.
10. The Department reserves the right to:
    a. dispose of any portion of the premises herein described during the term of this Permit. If possible, proper notice of sale or disposition will be given Permittee. However, failure to notify Permittee will not affect this right.
    b. lease said premises for exploration and production of any or all minerals, including coal, gas, oil, sand, gravel, etc.
    c. grant rights-of-way and easements of any kind and nature over and across said premises, and to grant or exercise all other rights and privileges of every kind and nature not herein specifically granted.
11. Permittee and occupants are responsible for the payment of all utility bills including water, electricity, gas, etc.
12. Permittee agrees to comply with all requirements herein, and, if for any reason Permittee violates or neglects to fulfill such requirements, this permission for use shall terminate and Permittee shall forfeit all rights and payments made hereunder. Should Permittee remain in possession of said premises after cancellation or expiration of this Permit, said Permittee shall be considered as tenant or tenants holding over without permission and may be evicted from said premises.
13. Permittee shall comply with all applicable (including but not limited to all environmental) laws, regulations and codes and will obtain any necessary Permits in connection with its use of the Premises.
14. Permittee shall reimburse the Department for any repairs to the Premises resulting from damage.
15. Permittee shall report, in writing, to the Department Representative, all incidents related to the use of this Permit that result in personal injury, death, or property damage. Incidents resulting in personal injury, death, or property damage (estimated to exceed $300.00) must be reported to the Department Representative immediately by telephone or in person, followed by a written report.
16. The Department shall have the right at all reasonable times during the term of this Permit to enter the premises for the purposes of making any inspections, repairs, additions or alterations as may be deemed appropriate by the Department for the preservation of the Premises.
17. Permittee shall comply with the Elliot-Larsen Civil Rights Act, 1976 PA as amended, CML 37. 2101 et seq.; MSA 3.548 (101) et seq.; the Persons with Disabilities Civil Rights Act, 1976 PA 220, as amended MCL 37.1101; MSA 3.500 (101) et seq., and all other federal, state and local fair employment practices and equal opportunity laws and covenants that it shall not discriminate against any employee or applicant for employment, to be employed in the performance of this contract, with respect to his or her hire, tenure, terms, conditions or privileges of employment, or any matter directly or indirectly related to employment, because of his or her race, religion, color, national origin, age, sex, height, weight, marital status, or physical or mental disability that is unrelated to the individual's ability to perform the duties of a particular job or position. Permittee agrees to include in every subcontract entered into for the performance of this Permit, this covenant not to discriminate in employment. A breach of this covenant is a material breach of this Permit.
18. Permittee shall comply with the Employers Engaging in Unfair Labor Practices Act, 1980, PA 278, as amended, MCL 423.321 et seq., MSA 17.458 (21) et seq.
19. There shall not be any disturbance to survey corners and associated witness trees.

CONDITIONS AND REQUIREMENTS (CONT'D)

20. **INSURANCE**: Applicant shall furnish to the Department, **prior to issuance of written permission**, a policy of liability insurance which provides as follows:
    a. Names of Insured, the Applicant, its officers, employees, and agents;
    b. Coverage against all known and unknown hazards arising from the acts and omissions of the Applicant, its officers, employees, and agents;
    c. Coverage for Applicant's contractually assumed obligation to indemnify and hold harmless the State of Michigan, its departments, officers, employees and agents;
    d. A term of coverage for not less than the term of use;
    e. Liability insurance coverage with respect to personal injury, death, and property damage to the limits described in the Guidelines for Liability Insurance Requirements for User Groups;
    f. That the policy will not be cancelled, or its provisions modified or deleted, unless and until the insurer first sends thirty (30) days' written notice to the Department representative shown on permit.
21. **PERFORMANCE BOND:** A cash or surety bond shall be provided by Applicant, as a guarantee of faithful performance of the conditions of the Permit, prior to issuance of the Permit. As soon as security for the performance of the terms and conditions of the Permit or the settlement of claims incident thereto is no longer necessary, deposits in lieu of surety or cash bond will be returned to the Applicant/Permittee.
22. **CAMPING OUTSIDE A DESIGNATED CAMPGROUND:** If camping involves five or more sites (thirty-two or more individuals or five or more recreational units), a Temporary Campground Permit must be obtained from the local county health department. Copies of the Permit must be provided to the Department before use.
23. **CUTTING OR REMOVAL OF TREES/VEGETATION:** Cutting or removal of trees/vegetation within the Permit area shall occur only if specifically authorized, in writing, by the Department Representative. The fee to cut or clear the authorized location shall be paid prior to cutting and clearing activities by the Permittee at the Department of Natural Resources' standard fee schedule rates.
24. Permittee shall take all reasonable precautions to prevent and suppress forest fires.
25. **BRUSH, STUMPS, OR DEBRIS:** All brush, stumps, or debris resulting from operations under this Permit shall be disposed of as directed by the Department Representative.
26. **BRIDGES, CULVERTS, CORDUROY:** No bridges, culverts, corduroy, or other road improvements made by Permittee on said premises shall be removed unless authorized in writing by the Department Representative.
27. **DAMAGES:** The Permittee shall be held liable for any damages caused by operations under this Permit which may arise to forest growth, fences, crops, buildings or other improvements on State-owned property. This shall be as determined by the Department Representative.
28. **ADDITIONAL REQUIREMENTS:** Permittee shall review any additional site specific or use specific requirements (Exhibits) provided by the Department and ascertain agreement by Permittee's authorized representative's signature and date on each Exhibit. This Permit shall not be effective until such agreement is made.
29. **LIABILITY:** Permittee hereby releases, waives, discharges and covenants not to sue the State of Michigan, its departments, officers, employees and agents, from any and all liability to Permittee, its officers, employees and agents, for all losses, injury, death or damage, and any claims or demands therefore thereto, on account of injury to person or property, or resulting in death of Permittee, its officers, employees or agents, in reference to the activities authorized by this Permit.
30. **INDEMNIFICATION:** Permittee hereby covenants and agrees to indemnify and save harmless, the State of Michigan, its departments, officers, employees and agents, from any and all claims and demands, for all loss, injury, death or damage, that any person or entity may have or make, in any manner, arising out of any occurrence related to (1) issuance of this Permit; (2) the activities authorized by this Permit; and (3) the use or occupancy of the premises which are the subject of this Permit by the Permittee, its employees, contractors, or its authorized representatives.
31. **PENALTY NOTICE:** Non-compliance with terms of the written permission, if granted, will be basis for forfeiture of some or all of the performance bond, termination of the written permission, and denial of future use applications. Permissions issued under this policy do not exempt the Applicant/User from complying with existing statutes.

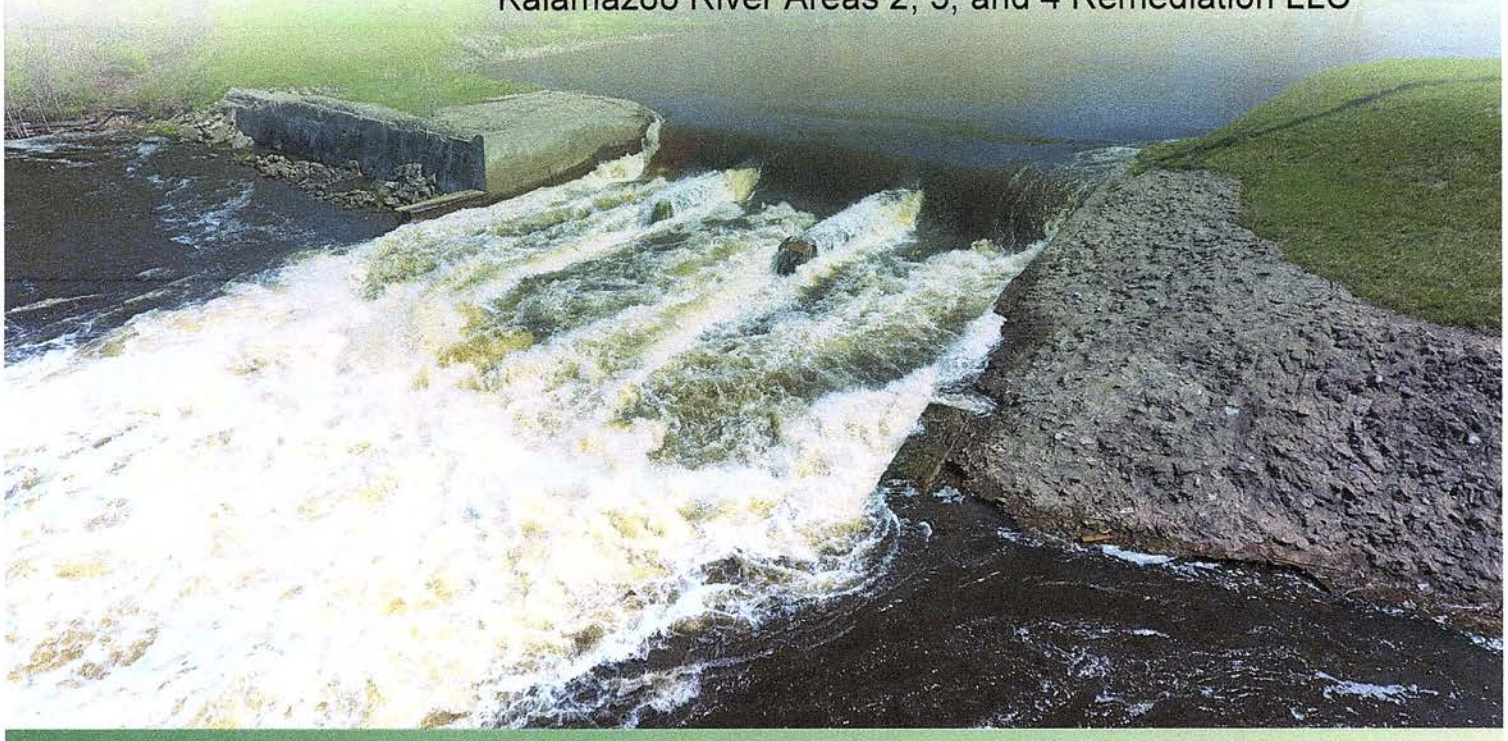
Kalamazoo river cleanup group
AREAS 2, 3 AND 4 TCRA

April 13, 2020

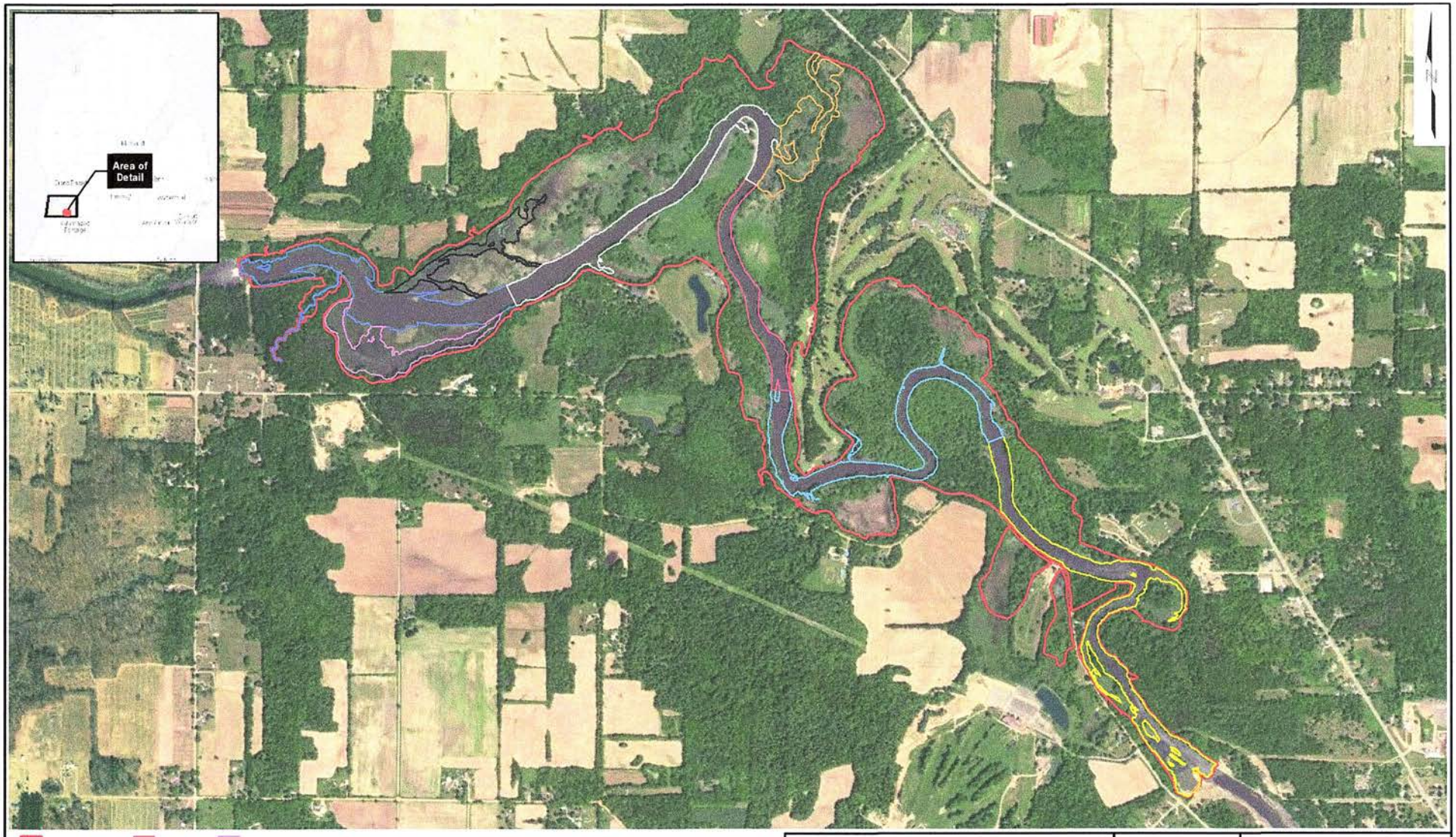
Mussel Work Plan

OU5 Area 4 Time-Critical Removal Action
Allied Paper/Portage Creek/
Kalamazoo River Superfund Site

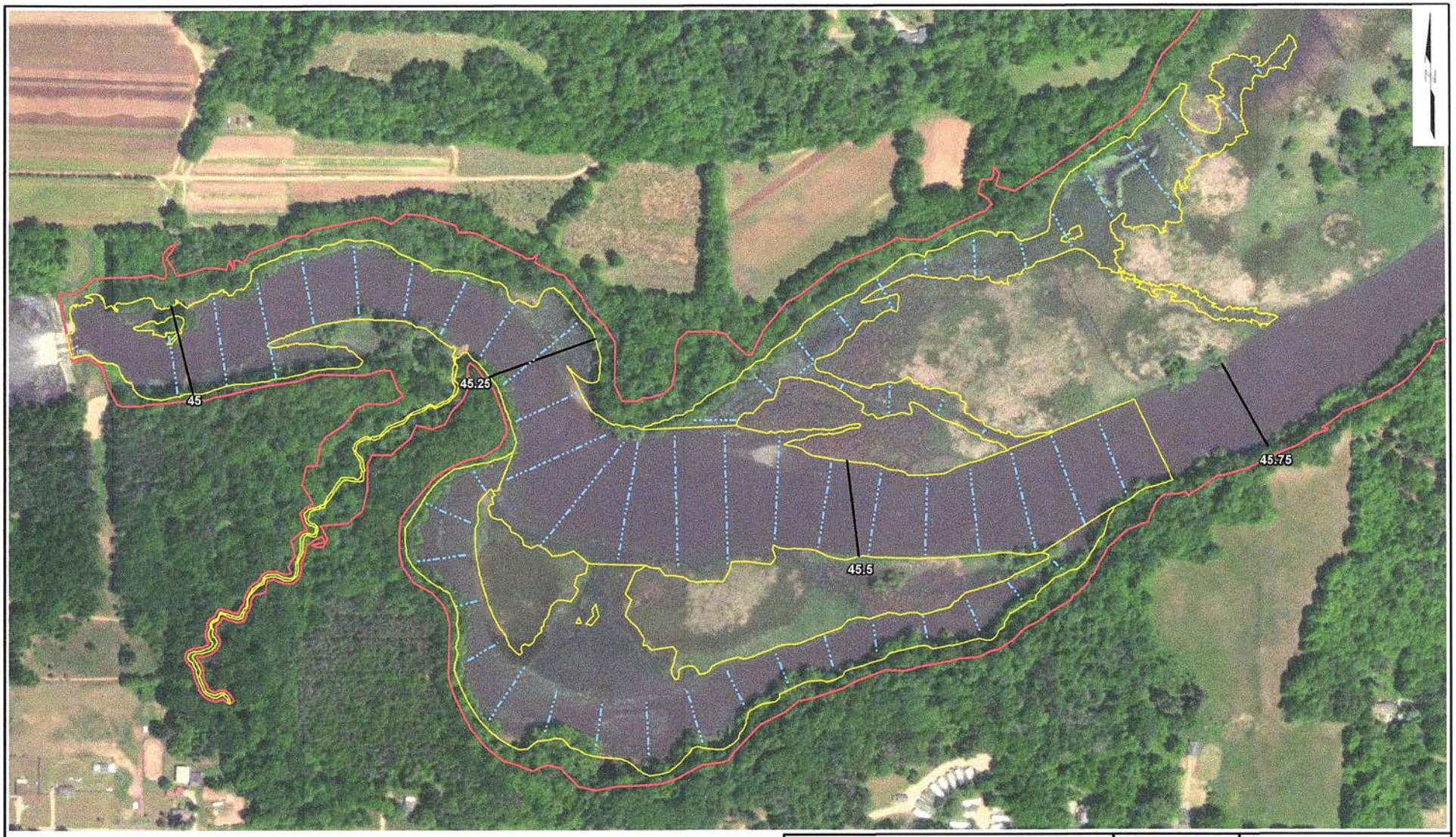
Prepared for:
Kalamazoo River Areas 2, 3, and 4 Remediation LLC



GEI Consultants



\\Sac1s-fs01\GIS\Projects\2000273_Kalamazoo_River_Cleanup_Program\GIS\A4_TCRA_WP\200330_A4_Mussel_Location.mxd



Mussel Reconnaissance Transect
1/4 River Mile Marker Lines
Area 4 Subarea Boundary
Area 4 Boundary

0 150 300
SCALE, FEET

OU5 Allied Paper/Portage Creek/Kalamazoo River Superfund Site
Area 4 TCRA - Allegan County, Michigan

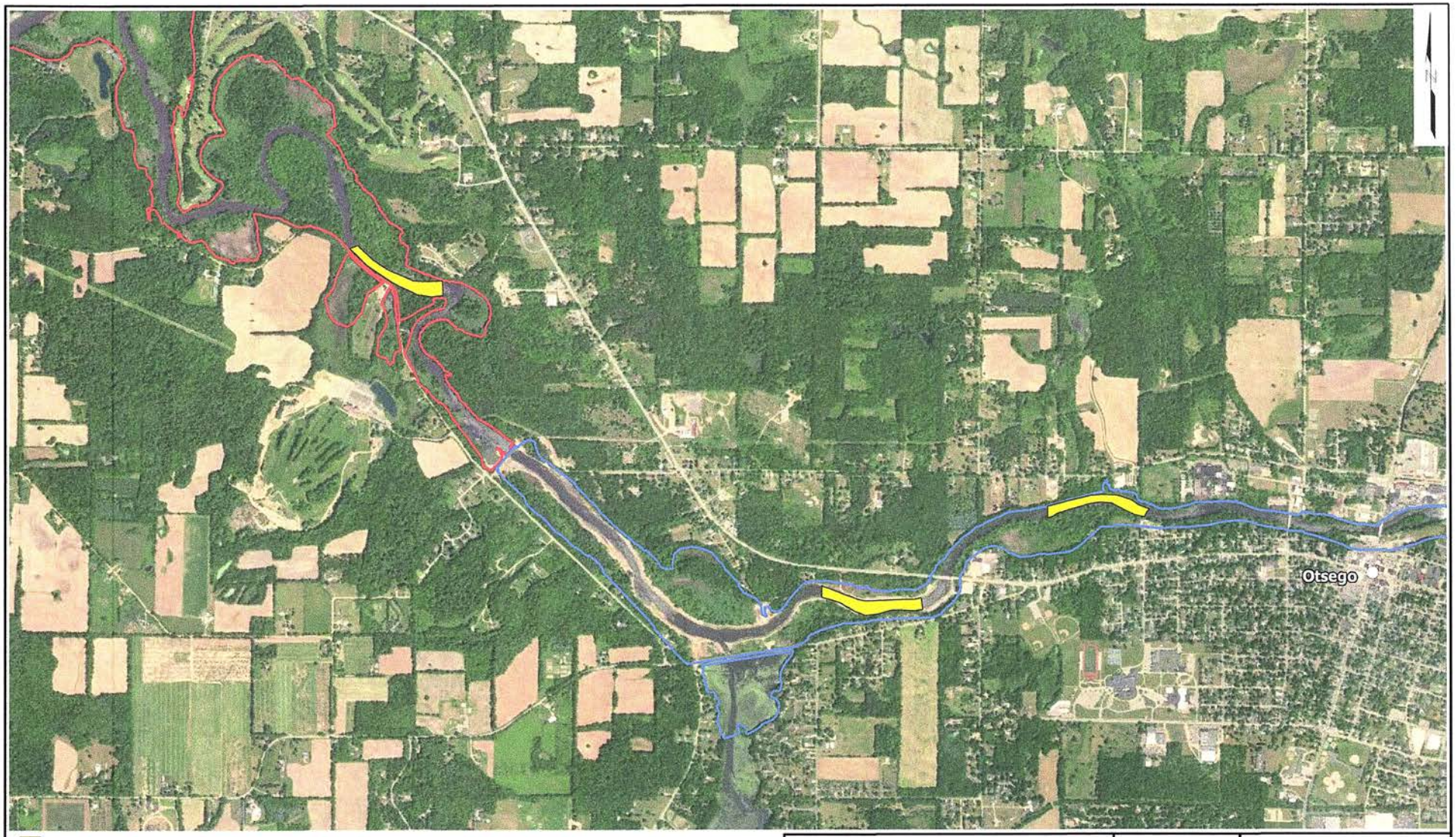
Kalamazoo River Areas 2, 3, and 4 Remediation LLC

Kalamazoo river cleanup group
AREAS 2, 3 AND 4 TCRA

SUBAREAS E, F, AND G
PROPOSED MUSSEL
RECONNAISSANCE TRANSECTS

Project 2000273 | March 2020 | Fig. 2

\\Sac1s-fs01\GIS\Projects\2000273_Kalamazoo_River_Cleanup_Program\GIS\A4_TCRA_WP\20031 8_A4_Mussel_Transects.mxd



Potential Mussel Relocation Site
Area 3 Boundary
Area 4 Boundary

*Sites are approximated and will be sized in accordance with number of mussels found.

0 750 1,500
SCALE, FEET

OU5 Allied Paper/Portage Creek/Kalamazoo River Superfund Site
Area 4 TCRA - Allegan County, Michigan

Kalamazoo River Areas 2, 3, and 4 Remediation LLC

Kalamazoo river cleanup group
AREAS 2, 3 AND 4 TCRA

Project 2000273

POTENTIAL RELOCATION SITES FOR AREA 4 TCRA MUSSELS

March 2020 Fig. 3

\\Sac1s-fs01\GIS\Projects\2000273_Kalamazoo_River_Cleanup_Program\GIS\A4_TCRA_WP\200330_A4_Mussel_Relocation.mxd

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY): 04/01/2020

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must have ADDITIONAL INSURED provisions or be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER
MARSH USA, INC.
20 CHURCH STREET, 8TH FLOOR
HARTFORD, CT 06103
Attn: Hartford.certrequest@Marsh.com

CN102051728-COD-GAWUX-20-21

CONTACT NAME: Alicia M. Lynde
PHONE (A/C, No, Ext): 860-723-5670 **FAX (A/C, No):**
E-MAIL ADDRESS: Alicia.M.Lynde@marsh.com

INSURER(S) AFFORDING COVERAGE	NAIC #
INSURER A : National Union Fire Ins. Co. of Pittsburgh, PA	19445
INSURER B : Steadfast Insurance Company	26387
INSURER C : AIU Insurance Co	19399
INSURER D :	
INSURER E :	
INSURER F :	

INSURED
GEI Consultants of Michigan, P.C.(5700)
5225 Edgewater Drive Office
Allendale, MI 49401

COVERAGES **CERTIFICATE NUMBER:** NYC-010863668-00 **REVISION NUMBER:** 0

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSD	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS		
A	X COMMERCIAL GENERAL LIABILITY	X	X	GL 518-02-76	03/01/2020	03/01/2021	EACH OCCURRENCE	$	2,000,000
	CLAIMS-MADE X OCCUR						DAMAGE TO RENTED PREMISES (Ea occurrence)	$	300,000
							MED EXP (Any one person)	$	25,000
							PERSONAL & ADV INJURY	$	2,000,000
	GEN'L AGGREGATE LIMIT APPLIES PER:						GENERAL AGGREGATE	$	4,000,000
	X POLICY X PRO-JECT LOC						PRODUCTS - COMP/OP AGG	$	4,000,000
	OTHER:							$	
A	AUTOMOBILE LIABILITY	X	X	CA 296-17-05 (AOS)	03/01/2020	03/01/2021	COMBINED SINGLE LIMIT (Ea accident)	$	2,000,000
A	X ANY AUTO			CA 296-17-04 (MA)	03/01/2020	03/01/2021	BODILY INJURY (Per person)	$	
	OWNED AUTOS ONLY / SCHEDULED AUTOS						BODILY INJURY (Per accident)	$	
	X HIRED AUTOS ONLY / NON-OWNED AUTOS ONLY						PROPERTY DAMAGE (Per accident)	$	
							Comp/Coll Deductible	$	$250/$250
B	UMBRELLA LIAB X OCCUR	X	X	SXS 7447104-01	03/01/2020	03/01/2021	EACH OCCURRENCE	$	10,000,000
	X EXCESS LIAB CLAIMS-MADE						AGGREGATE	$	10,000,000
	DED RETENTION $							$	
A	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY		X	WC 012-01-6047 (AOS)	03/01/2020	03/01/2021	X PER STATUTE OTH-ER		
C	ANYPROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? (Mandatory in NH) Y/N: N	N/A		WC 012-01-6046 (CA)	03/01/2020	03/01/2021	E.L. EACH ACCIDENT	$	1,000,000
	If yes, describe under DESCRIPTION OF OPERATIONS below						E.L. DISEASE - EA EMPLOYEE	$	1,000,000
							E.L. DISEASE - POLICY LIMIT	$	1,000,000
B	PROFESSIONAL ENVIRONMENTAL CONSULTANT'S LIABILITY			PEC 0233595-04	03/01/2020	03/01/2021	Each Claim:		5,000,000
							Aggregate:		5,000,000

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)

RE: Kalamazoo River Areas 2, 3, and 4 TCRA.
State of Michigan, Its Departments, Officers, Employees and Agents are additional insured on the General Liability policy as required by written contract. Coverage is primary and non-contributory where required by written contract. Contractual Liability is included on the General Liability policy as required by written contract. Waiver of subrogation is applicable where required by written contract and allowed by law.

CERTIFICATE HOLDER

State of Michigan
530 West Allegan, 2nd Floor
Lansing, MI 48933

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE
of Marsh USA Inc.
Craig A. Parrow

AGENCY CUSTOMER ID: CN102051728

LOC #: Hartford

ADDITIONAL REMARKS SCHEDULE

AGENCY		NAMED INSURED
MARSH USA, INC.		GEI Consultants of Michigan, P.C.(5700) 5225 Edgewater Drive Office Allendale,MI 49401
POLICY NUMBER		
CARRIER	NAIC CODE	EFFECTIVE DATE:

ADDITIONAL REMARKS

THIS ADDITIONAL REMARKS FORM IS A SCHEDULE TO ACORD FORM,

FORM NUMBER: 25 FORM TITLE: Certificate of Liability Insurance

EXCESS PROFESSIONAL LIABILITY:

CARRIER: LEXINGTON INSURANCE COMPANY
POLICY #031711057
POLICY PERIOD: 03/01/2020 - 03/01/2021
LIMIT: $10,000,000

PRIMARY PROFESSIONAL LIABILITY: PEC 0233595-04
ADDITIONAL POLICY LIMITS:

TRANSPORTATION OF MATERIALS BY CARRIER
$10,000,000 TRANSPORTATION EACH CLAIM
$10,000,000 TOTAL ALL CLAIMS

The General Liability, Automobile Liability, Contractors Pollution and Excess Liability policies provide Additional Insured status where required by written contract or agreement subject to policy terms, conditions, and exclusions.

This Insurance is Primary and Non-contributory on the General Liability, Automobile Liability, Contractors Pollution and Excess Liability subject to the policy terms, conditions, and exclusions.

Severability of interest applies where required by written contract or agreement with regards to General Liability

The General Liability, Automobile Liability, Workers Compensation, Contractors Pollution and Excess Liability policies provide Waiver of Subrogation where required by written contract or agreement.

THE PROFESSIONAL ENVIRONMENTAL CONSULTANTS LIABILITY POLICY EVIDENCED ON THIS CERTIFICATE IS A COMBINED POLICY, POLLUTION COVERAGE IS INCLUDED.

Appendix C – Representative Photos

Photo 1. ***Actinonaias ligamentina*** **(Mucket) - right valve**

Photo 2. ***Actinonaias ligamentina*** **(Mucket) - left valve**

Photo 3. ***Actinonaias ligamentina*** **(Mucket) - dorsal view**

Photo 4. ***Actinonaias ligamentina*** **(Mucket) - ventral view**

Photo 5. ***Actinonaias ligamentina*** **(Mucket) - posterior view**

Photo 6. ***Actinonaias ligamentina*** **(Mucket) - anterior view**

Photo 7. ***Actinonaias ligamentina*** **(Mucket) - right valve**

Photo 8. ***Actinonaias ligamentina*** **(Mucket) - left valve**

Photo 9. ***Actinonaias ligamentina*** **(Mucket) - dorsal view**

Photo 10. ***Actinonaias ligamentina*** **(Mucket) - ventral view**

Photo 11. ***Actinonaias ligamentina*** **(Mucket) - posterior view**

Photo 12. ***Actinonaias ligamentina*** **(Mucket) - anterior view**

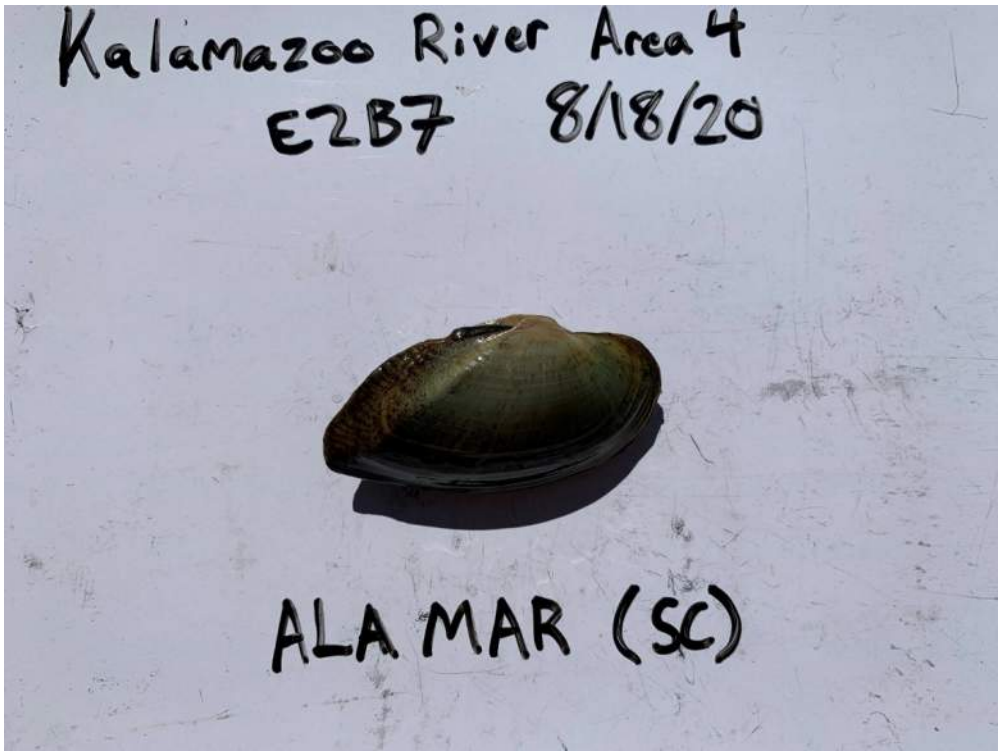


Photo 13. ***Alasmidonta marginata*** **(Elktoe) - right valve**

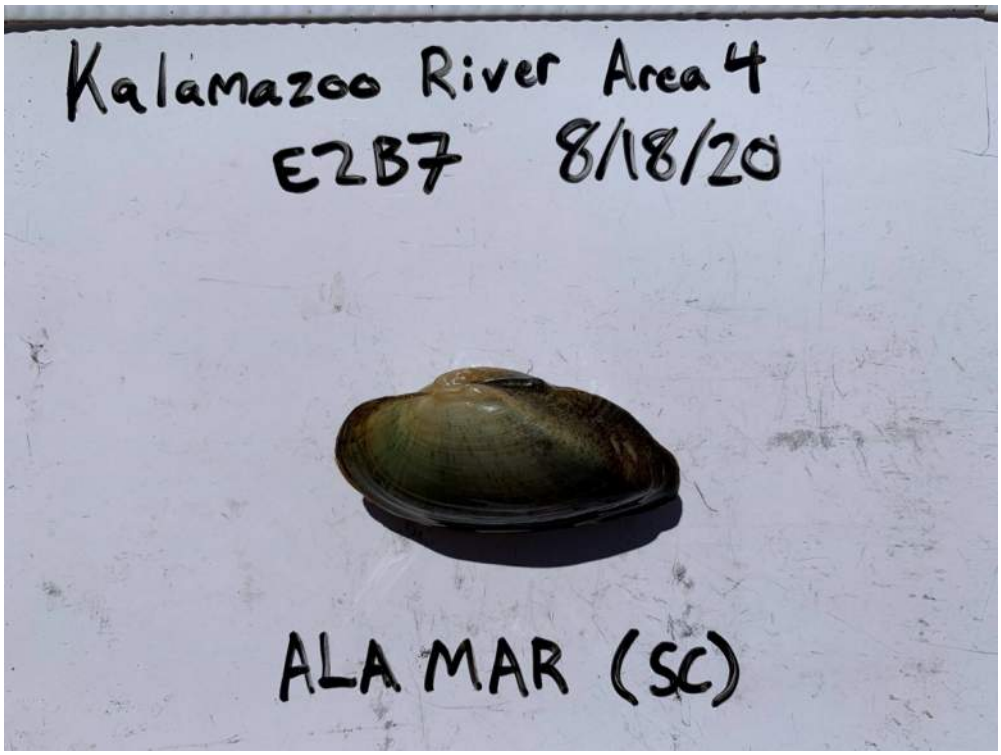


Photo 14. ***Alasmidonta marginata*** **(Elktoe) - left valve**

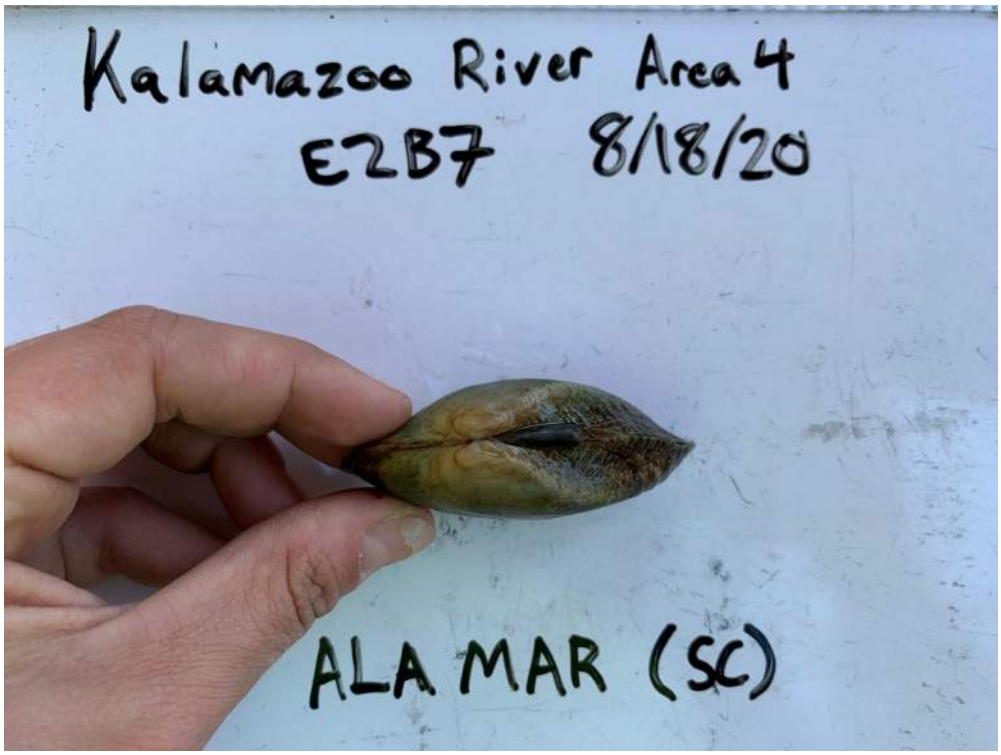


Photo 15. ***Alasmidonta marginata*** **(Elktoe) - dorsal view**

Photo 16. ***Alasmidonta marginata*** **(Elktoe) - ventral view**

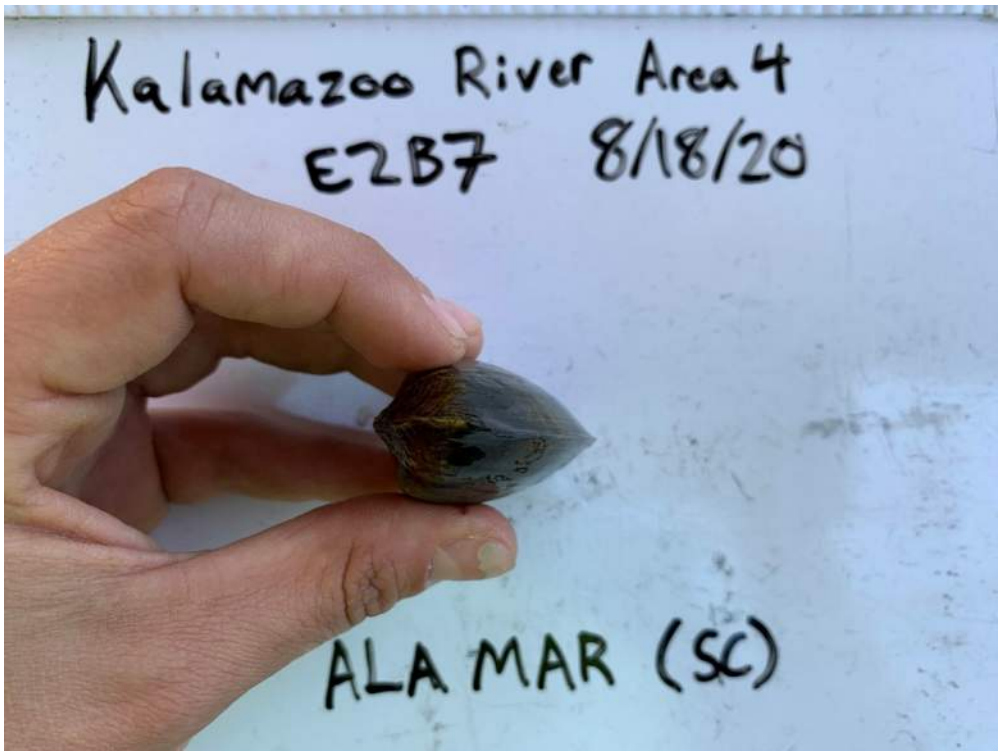


Photo 17. ***Alasmidonta marginata*** **(Elktoe) - posterior view**

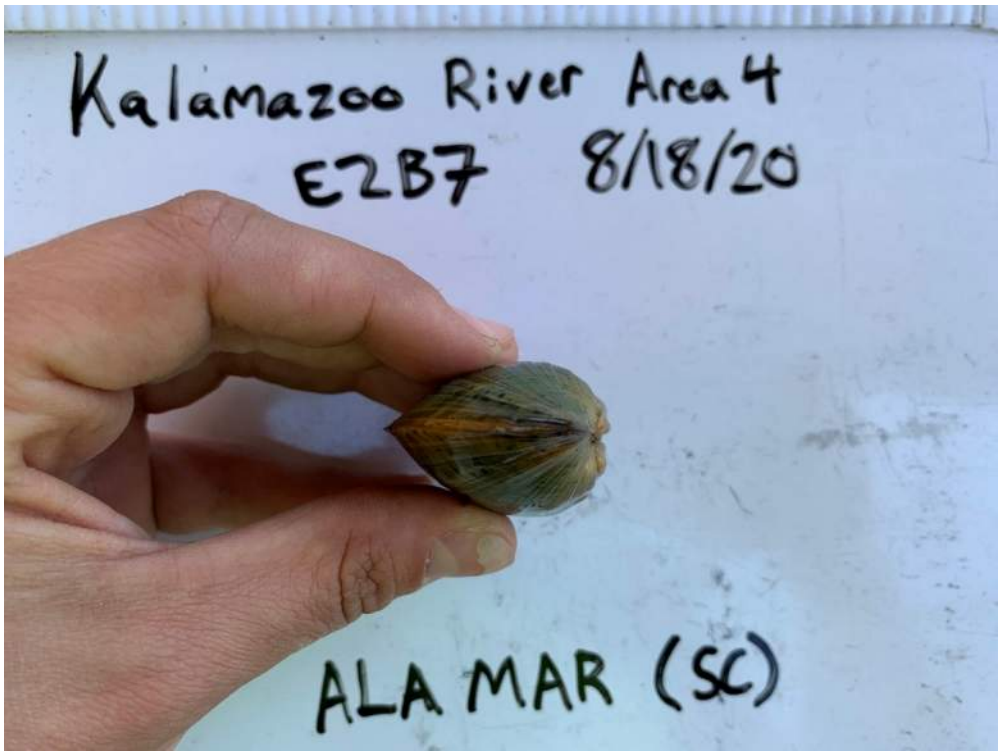


Photo 18. ***Alasmidonta marginata*** **(Elktoe) - anterior view**

Photo 19. ***Alasmidonta marginata*** **(Elktoe) - right valve**

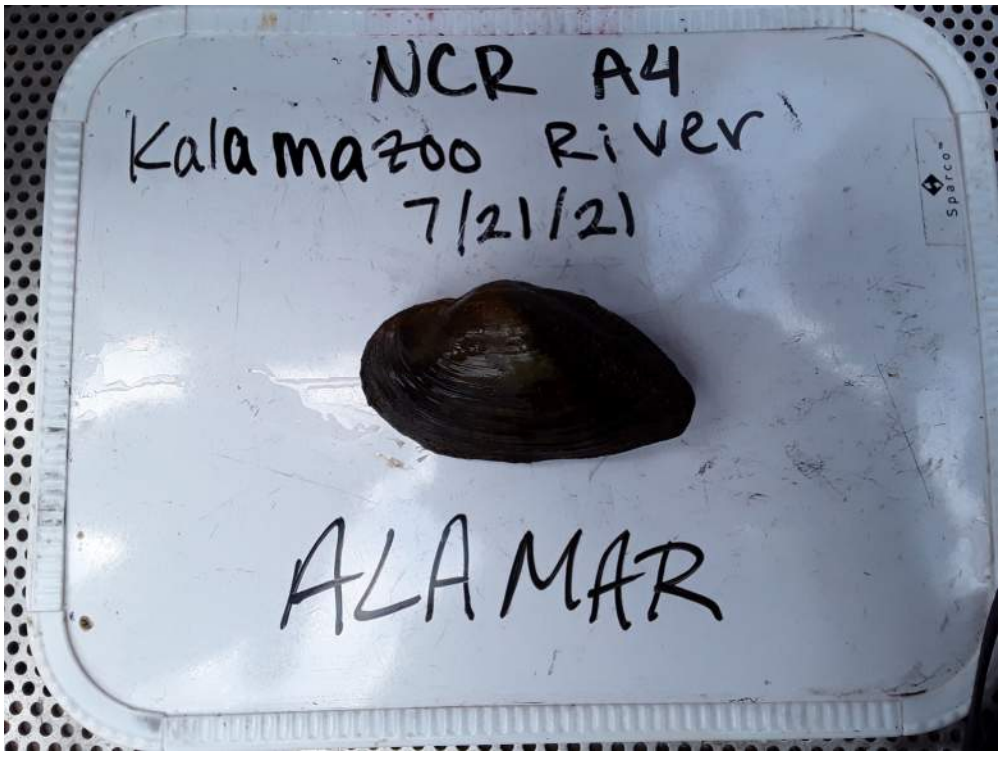


Photo 20. ***Alasmidonta marginata*** **(Elktoe) - left valve**

Photo 21. ***Alasmidonta marginata*** **(Elktoe) - dorsal view**

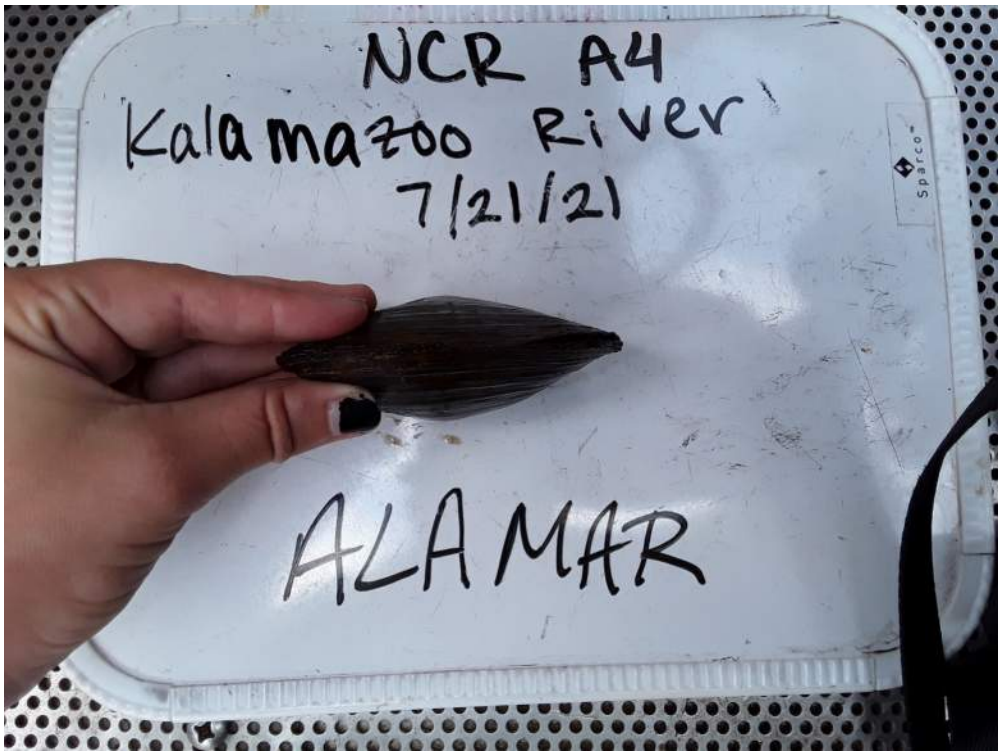


Photo 22. ***Alasmidonta marginata*** **(Elktoe) - ventral view**

Photo 23. ***Alasmidonta marginata*** **(Elktoe) - posterior view**

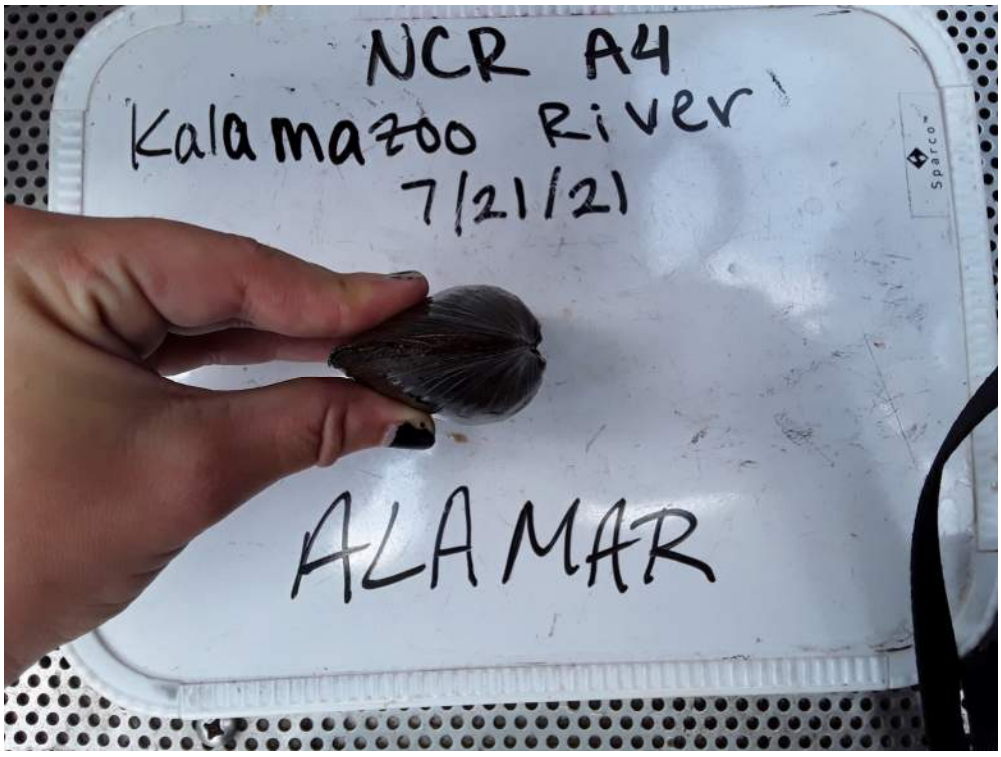


Photo 24. ***Alasmidonta marginata*** **(Elktoe) - anterior view**

Photo 25. *Fusconaia flava* (Wabash pigtoe) - right valve

Photo 26. *Fusconaia flava* (Wabash pigtoe) - left valve

Photo 27. *Fusconaia flava* (Wabash pigtoe) - dorsal view

Photo 28. *Fusconaia flava* (Wabash pigtoe) - ventral view

Photo 29. *Fusconaia flava* (Wabash pigtoe) - posterior view

Photo 30. *Fusconaia flava* (Wabash pigtoe) - anterior view

Photo 31. ***Fusconaia flava*** **(Wabash pigtoe) - right valve**

Photo 32. ***Fusconaia flava*** **(Wabash pigtoe) - left valve**

Photo 33. *Fusconaia flava* (Wabash pigtoe) - dorsal view

Photo 34. *Fusconaia flava* (Wabash pigtoe) - ventral view

Photo 35. ***Fusconaia flava*** **(Wabash pigtoe) - posterior view**

Photo 36. ***Fusconaia flava*** **(Wabash pigtoe) - anterior view**

Photo 37. ***Lampsilis siliquoidea*** **(Fatmucket) - right valve**

Photo 38. ***Lampsilis siliquoidea*** **(Fatmucket) - left valve**

Photo 39. *Lampsilis siliquoidea* (Fatmucket) - dorsal view

Photo 40. *Lampsilis siliquoidea* (Fatmucket) - ventral view

Photo 41. ***Lampsilis siliquoidea*** **(Fatmucket) - posterior view**

Photo 42. ***Lampsilis siliquoidea*** **(Fatmucket) - anterior view**

Photo 43. ***Lasmigona complanata*** **(White heelsplitter) - right valve**

Photo 44. ***Lasmigona complanata*** **(White heelsplitter) - left valve**

Photo 45. ***Lasmigona complanata*** **(White heelsplitter) - dorsal view**

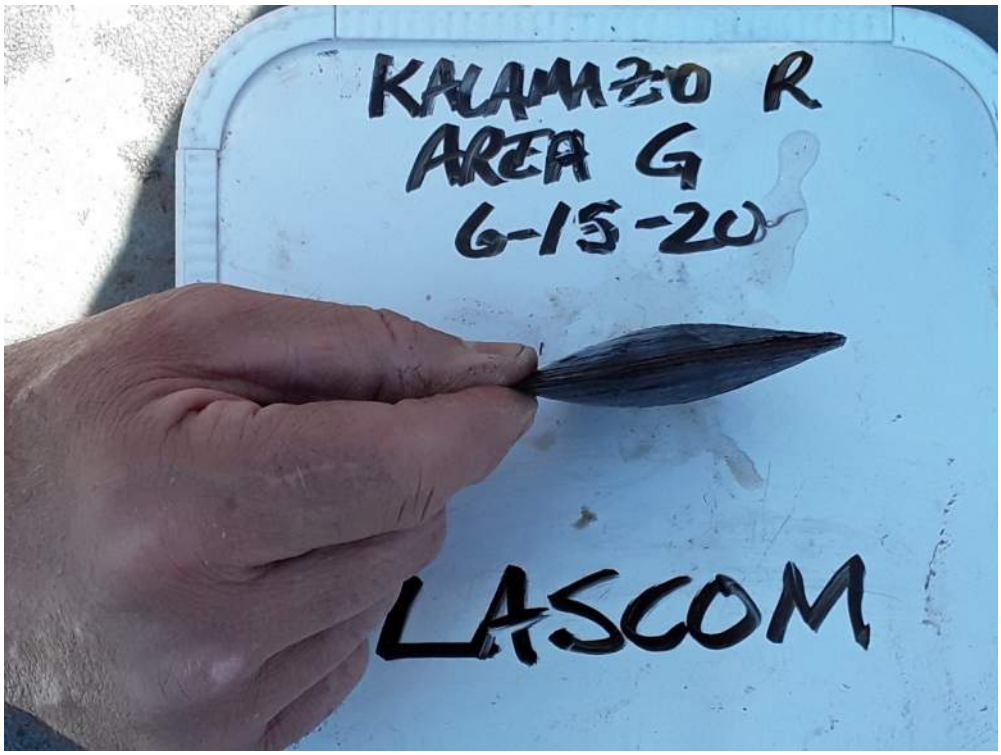


Photo 46. ***Lasmigona complanata*** **(White heelsplitter) - ventral view**

Photo 47. ***Lasmigona complanata*** **(White heelsplitter) - posterior view**

Photo 48. ***Lasmigona complanata*** **(White heelsplitter) - anterior view**

Photo 49. ***Lasmigona complanata*** **(White heelsplitter) - right valve**

Photo 50. ***Lasmigona complanata*** **(White heelsplitter) - left valve**

Photo 51. ***Lasmigona complanata*** **(White heelsplitter) - dorsal view**

Photo 52. ***Lasmigona complanata*** **(White heelsplitter) - ventral view**

Photo 53. ***Lasmigona complanata*** **(White heelsplitter) - posterior view**

Photo 54. ***Lasmigona complanata*** **(White heelsplitter) - anterior view**

Photo 55. ***Lasmigona complanata*** **(White heelsplitter) - right valve**

Photo 56. ***Lasmigona complanata*** **(White heelsplitter) - left valve**

Photo 57. ***Lasmigona complanata*** **(White heelsplitter) - dorsal view**

Photo 58. ***Lasmigona complanata*** **(White heelsplitter) - ventral view**

Photo 59. ***Lasmigona complanata*** **(White heelsplitter) - posterior view**

Photo 60. ***Lasmigona complanata*** **(White heelsplitter) - anterior view**

Photo 61. ***Pyganodon grandis*** **(Giant floater) - right valve**

Photo 62. ***Pyganodon grandis*** **(Giant floater) - left valve**

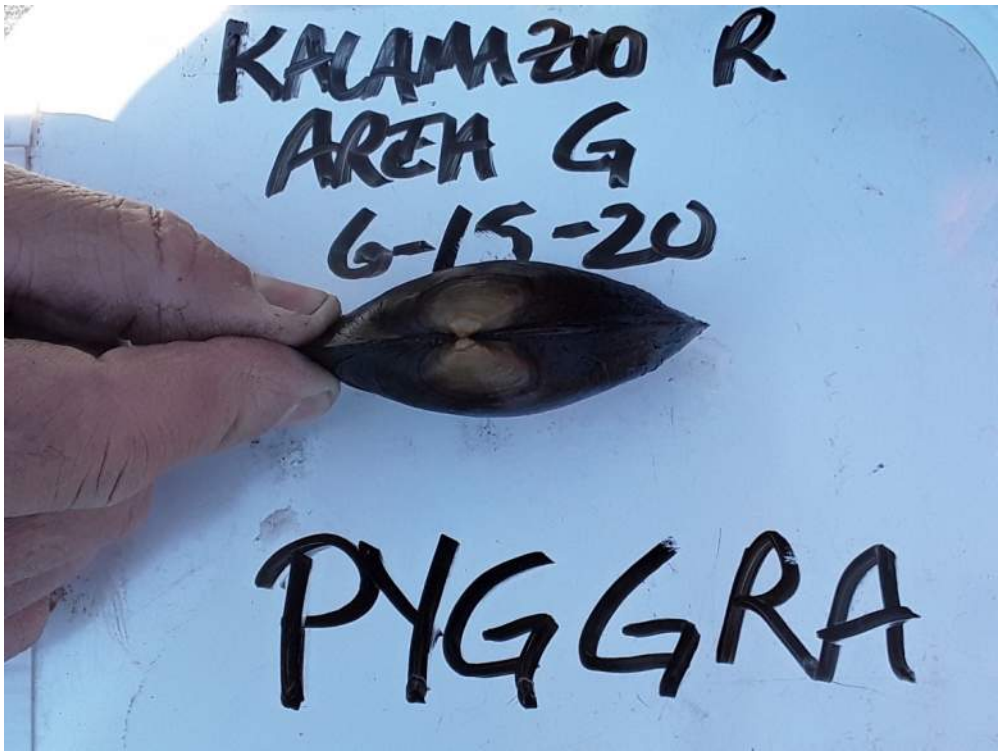


Photo 63. ***Pyganodon grandis*** **(Giant floater) - dorsal view**

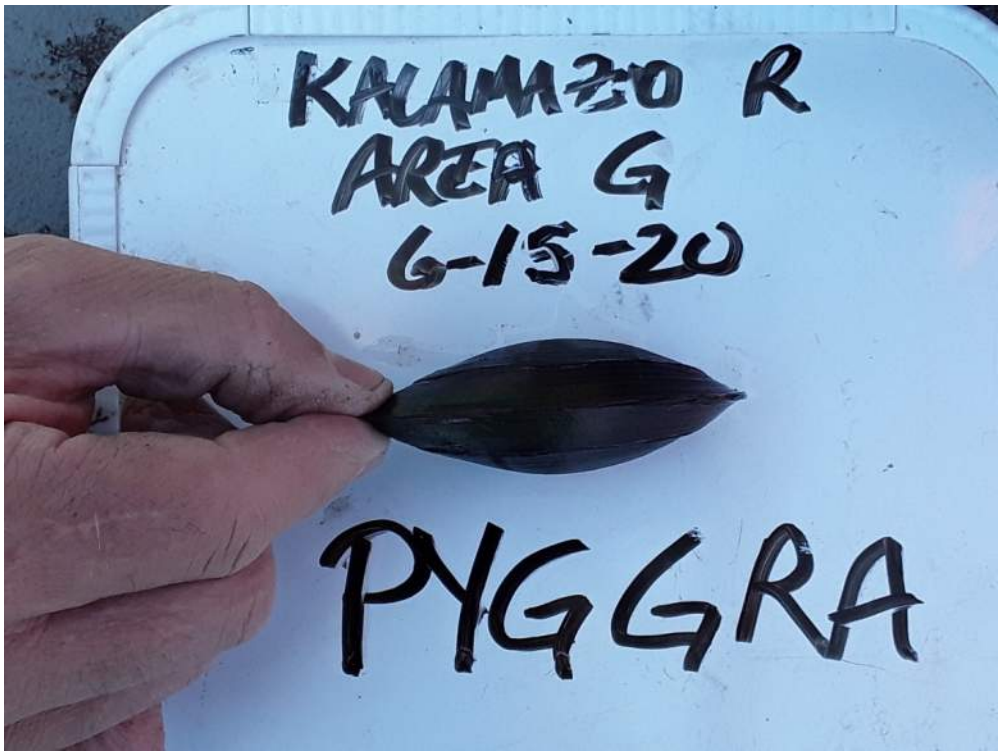


Photo 64. ***Pyganodon grandis*** **(Giant floater) - ventral view**

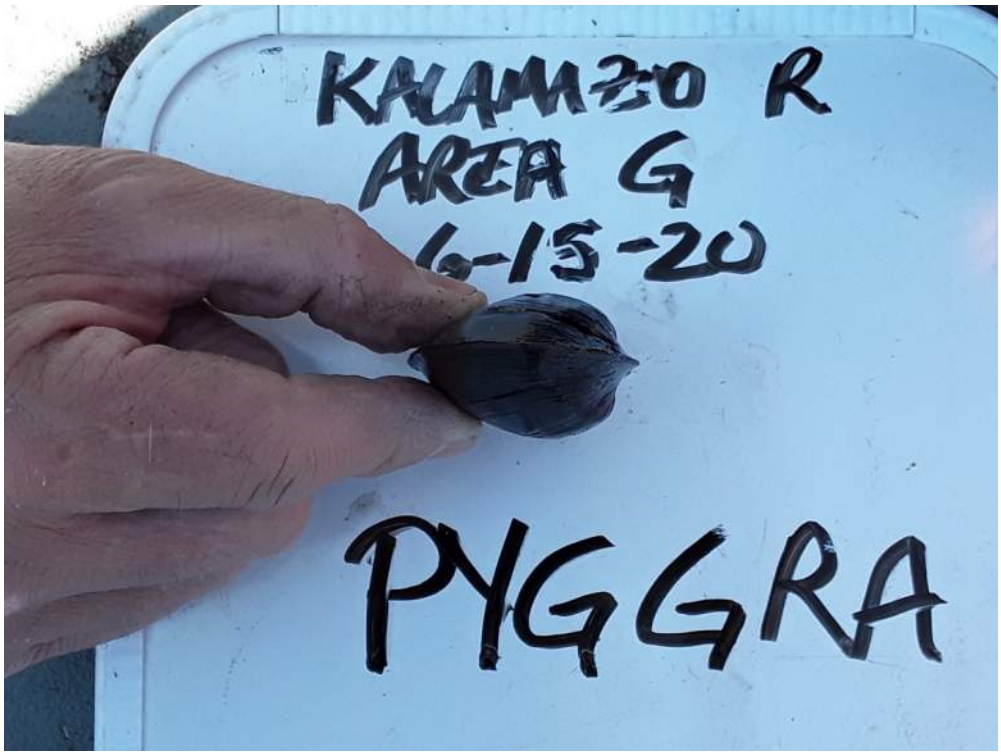


Photo 65. ***Pyganodon grandis*** **(Giant floater) - posterior view**

Photo 66. ***Pyganodon grandis*** **(Giant floater) - anterior view**

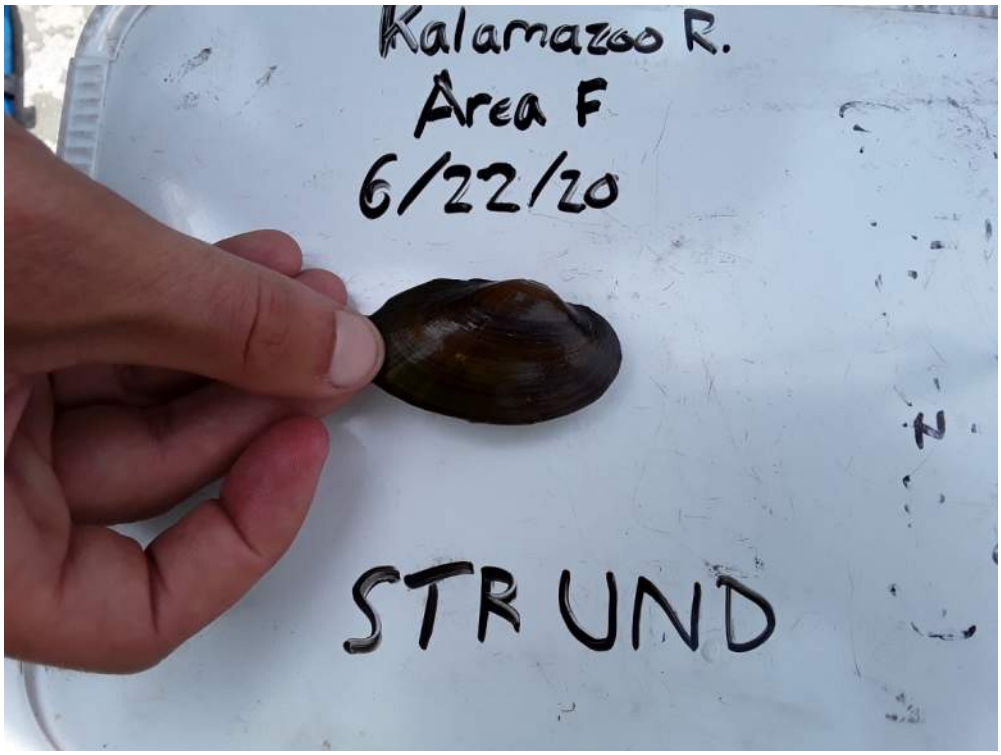


Photo 67. *Strophitus undulatus* (Strange floater) - right valve

Photo 68. *Strophitus undulatus* (Strange floater) - left valve

Photo 69. *Strophitus undulatus* (Strange floater) - dorsal view

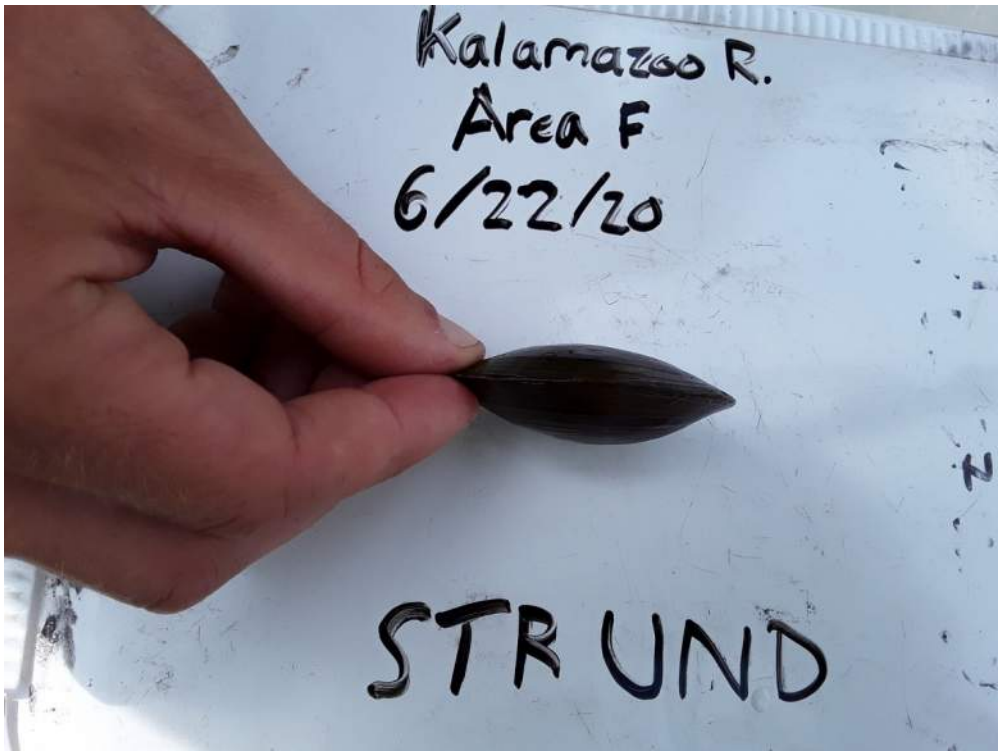


Photo 70. *Strophitus undulatus* (Strange floater) - ventral view

Photo 71. ***Strophitus undulatus*** **(Strange floater) - posterior view**

Photo 72. ***Strophitus undulatus*** **(Strange floater) - anterior view**

Photo 73. ***Strophitus undulatus*** **(Strange floater) - right valve**

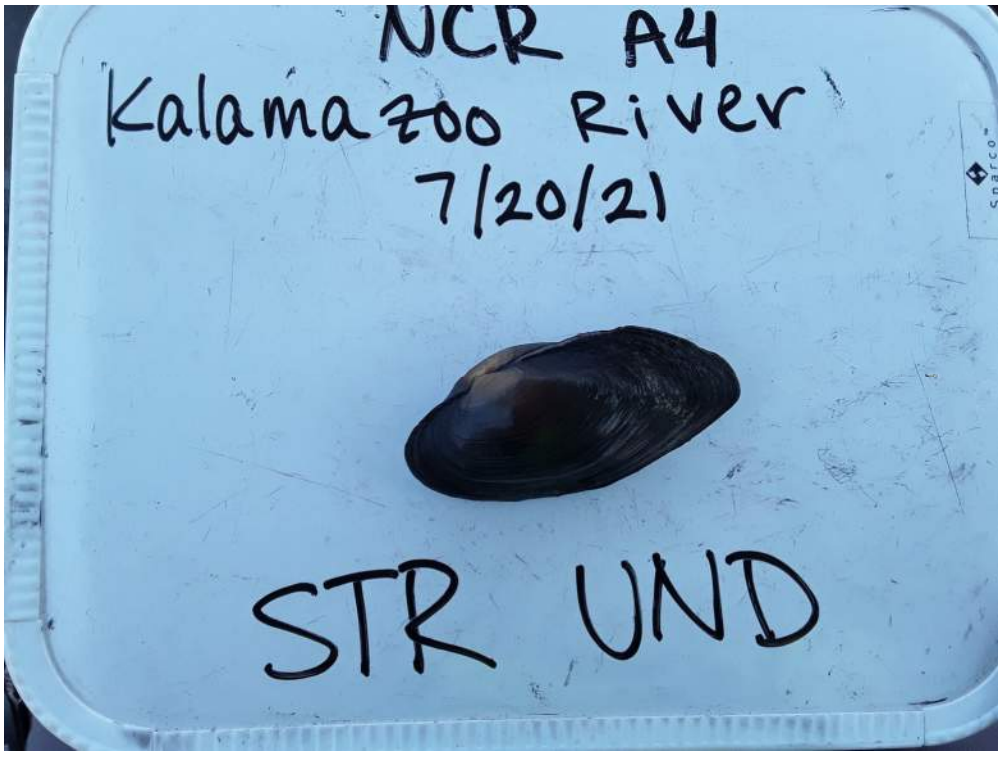


Photo 74. ***Strophitus undulatus*** **(Strange floater) - left valve**

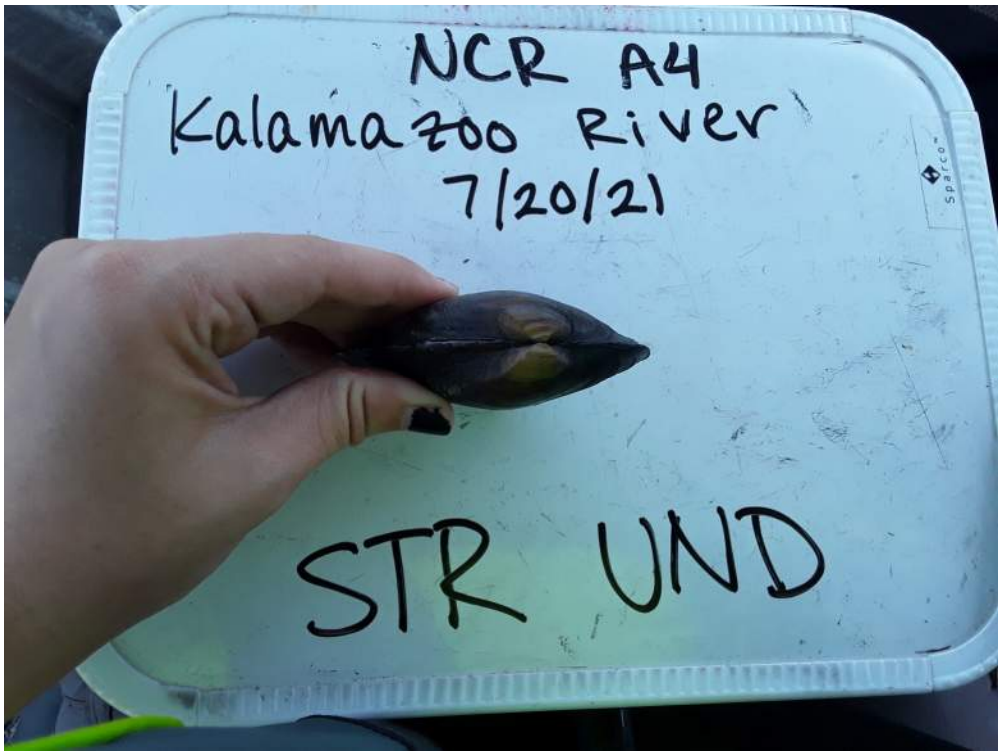


Photo 75. ***Strophitus undulatus*** **(Strange floater) - dorsal view**

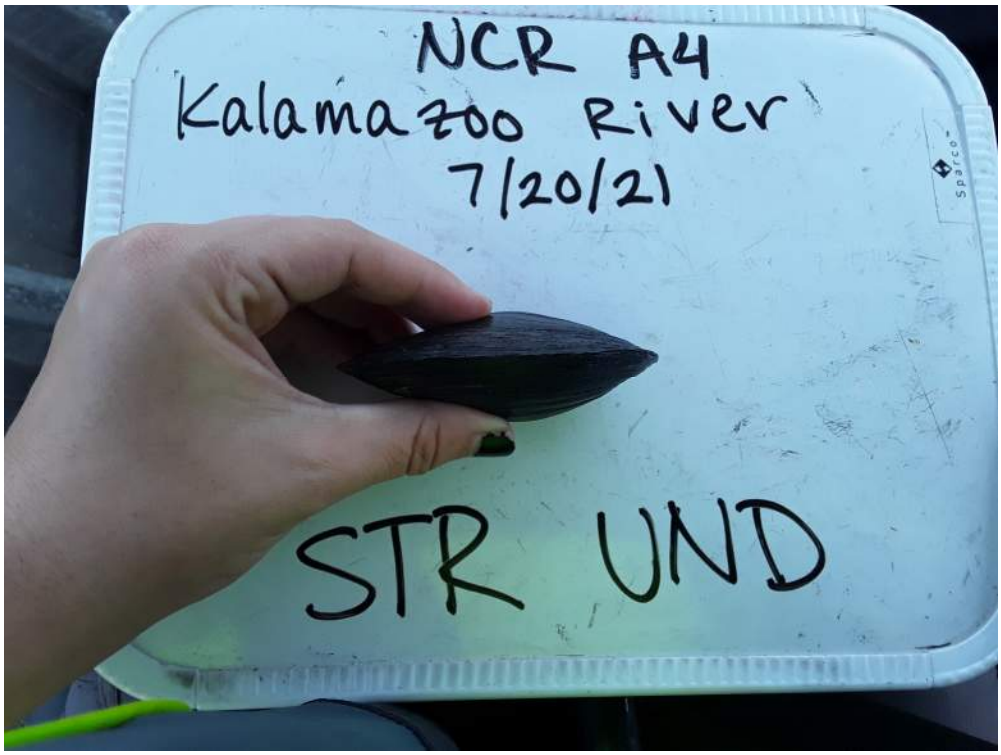


Photo 76. ***Strophitus undulatus*** **(Strange floater) - ventral view**

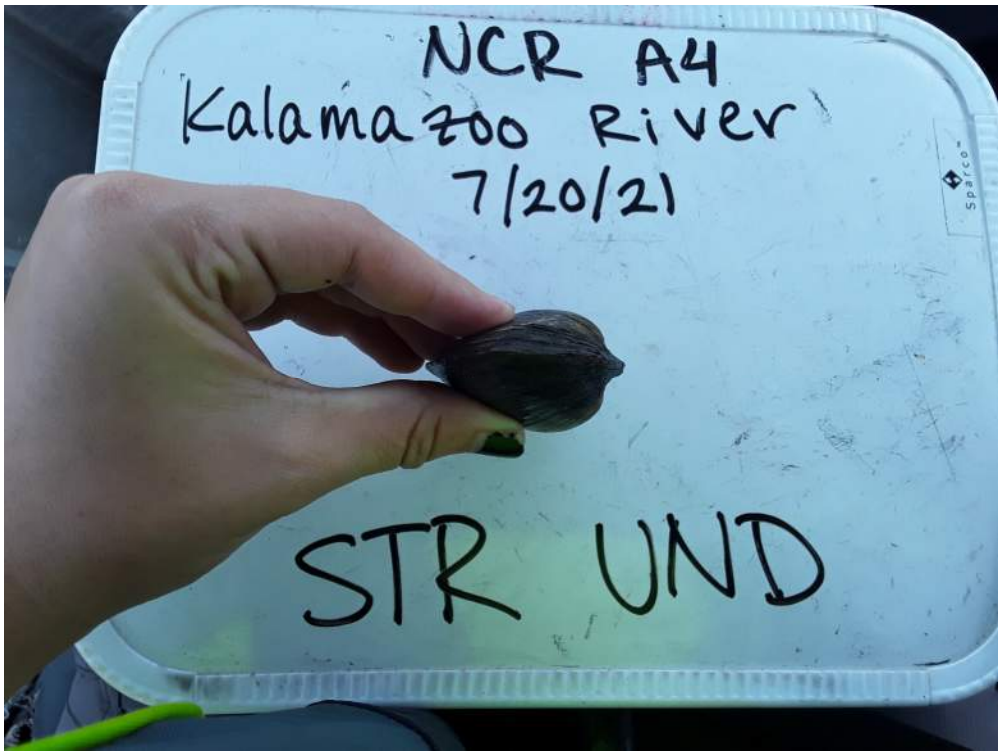


Photo 77. *Strophitus undulatus* (Strange floater) - posterior view

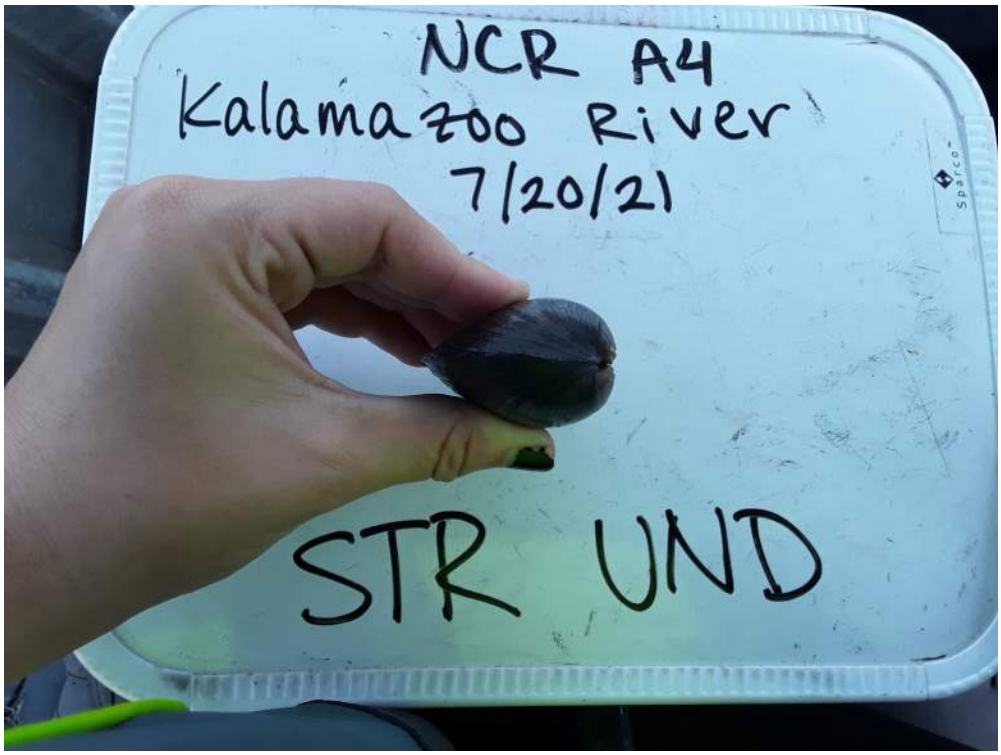


Photo 78. *Strophitus undulatus* (Strange floater) - anterior view

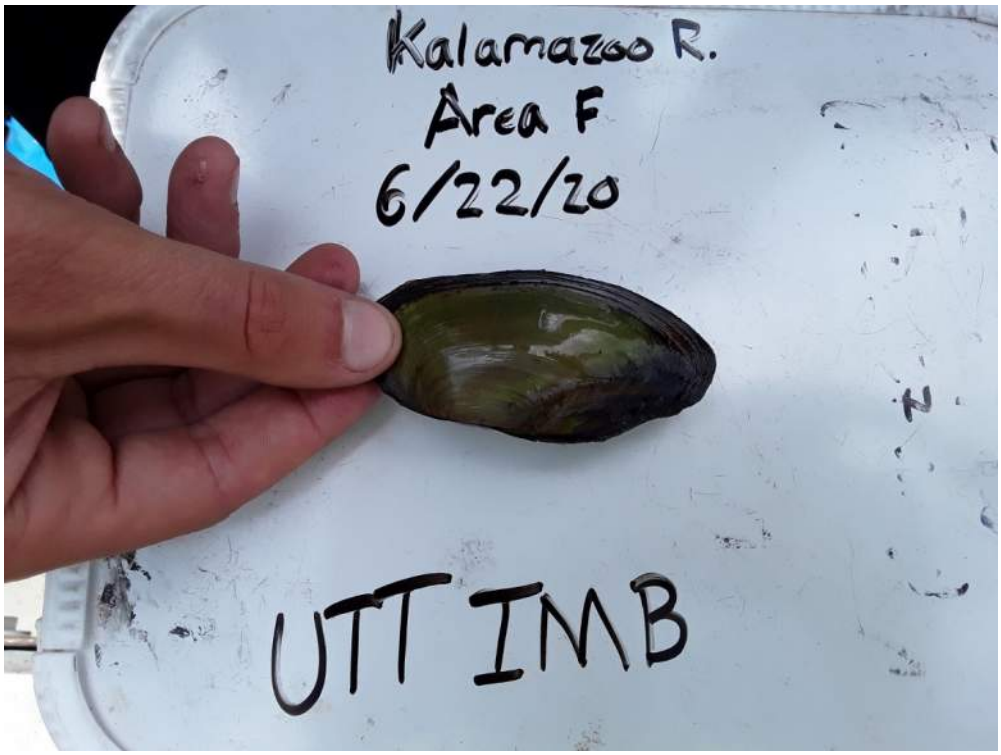


Photo 79. *Utterbackia imbecillis* (Paper pondshell) - right valve

Photo 80. *Utterbackia imbecillis* (Paper pondshell) - left valve

Photo 81. ***Utterbackia imbecillis*** **(Paper pondshell) - dorsal view**

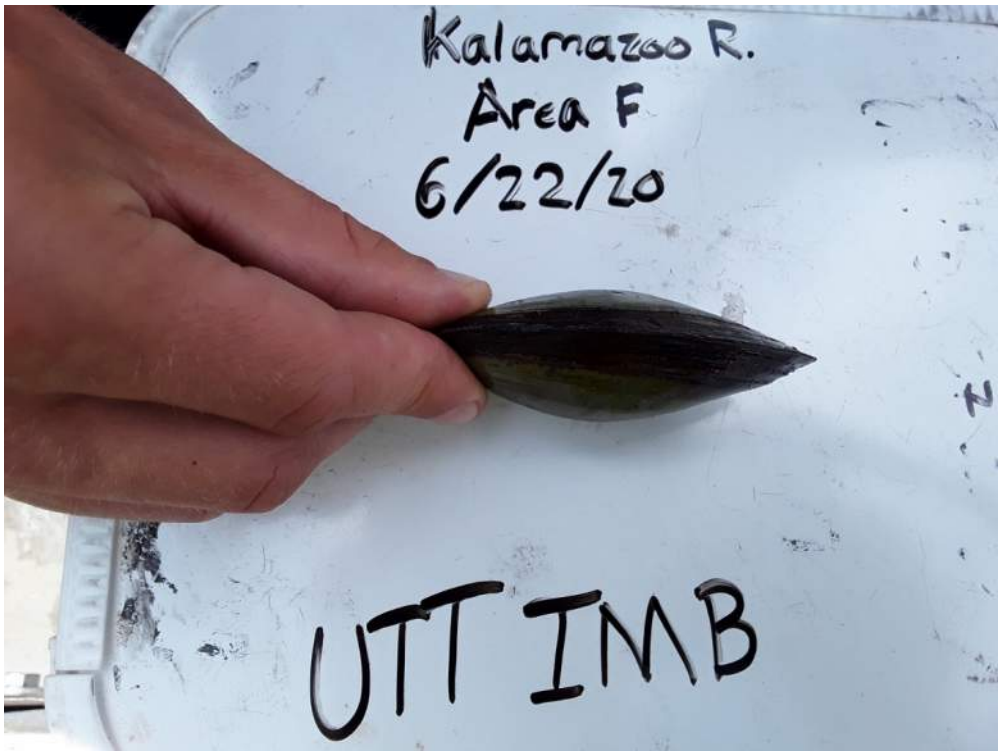


Photo 82. ***Utterbackia imbecillis*** **(Paper pondshell) - ventral view**

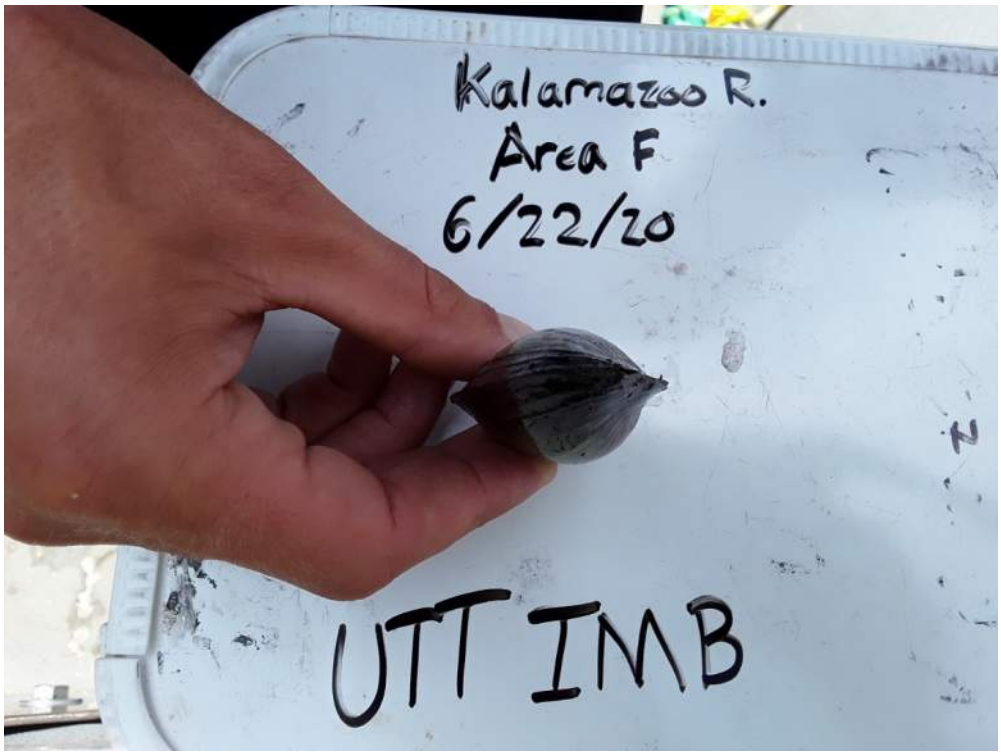


Photo 83. ***Utterbackia imbecillis*** **(Paper pondshell) - posterior view**

Photo 84. ***Utterbackia imbecillis*** **(Paper pondshell) - anterior view**

Photo 85. Representative site photo in Subarea E

Photo 86. Divers surveying in Subarea E

Photo 87. Representative site photo in Subarea E

Photo 88. Divers surveying in Subarea E

Photo 89. Divers surveying in Subarea E

Photo 90. Boat operator and biologist spotting divers surveying in cell (yellow buoys)

Photo 91. Divers surveying in Subarea F

Photo 92. Large patch of *Typha* spp. (cattails) in Subarea F

Photo 93. Divers surveying in heavy submerged aquatic vegetation in Subarea F

Photo 94. Representative substrate in Subarea F

Photo 95. Divers surveying in Subarea G

Photo 96. Divers relocating mussels at upstream relocation area

Photo 97. Representative photograph of mobile sand found throughout Subarea 4

Photo 98. Representative photograph of unconsolidated silt found throughout Area 4

Photo 99. Representative photograph of porous hardpan found in lower Subarea E

Photo 100. Representative photograph of hardpan found throughout Area 4

Photo 101. Large woody debris in Subarea E - deemed unsafe due to potential for diver entanglement

Photo 102. Large woody debris in Subarea E - deemed unsafe due to potential for diver entanglement

Photo 103. Previously submerged area within suitable mussel habitat polygon

Photo 104. Biologists surveying adjacent previously submerged area within suitable mussel habitat polygon